MUNICIPAL NEWS

Issued Monthly at Hammond, Ind.,
by Gillette Publishing Company, formerly
Engineering and Contracting Publishing Company

Executive and Editorial Offices:
221 East 20th St., Chicago, Ill.
Address all communications to the above office.

HALBERT P. GILLETTE, President and Editor
E. S. GILLETTE, Secretary

R. W. HUME, Vice-President
C. T. MURRAY, Managing Editor

Cleveland Office, 814 Union Mortgage Bldg.: E. C. KELLY, Manager
New York Office, 415 Lexington Avenue: ERWIN T. EYLER, Eastern Manager

The specialized publishing plan of Gillette Publishing Company provides four monthly magazines at the subscription rates listed at the right.

Water Works	**$2 00**
Roads and Streets	**2.00**
Engineering and Contracting	**2.00**
Municipal News	**2.00**

Foreign Postage 65c Extra

All four may be subscribed for at the special rate of $5.00 a year, and thus taken they provide a service completely covering the construction field.

Copyright, 1927, by Gillette Publishing Company

Vol. LXXIII AUGUST, 1927 No. 2

The Change of Name and Ownership of Municipal and County Engineering

Municipal Engineering was founded in 1890, and was the first American magazine in the municipal field. A few years ago its field was somewhat broadened and its name was changed to Municipal and County Engineering. Beginning with this issue it adopts a briefer name, Municipal News, and again returns to the narrow field of municipal activities that involve construction, maintenance and operation.

The new owners, Gillette Publishing Co. (formerly Engineering and Contracting Publishing Co.) publish three other monthly magazines. One of these, Roads and Streets, is the largest highway magazine in the world, both in point of paid circulation and advertising pages.

Water Works also has the largest paid circulation in the world in the hydraulic field.

Engineering and Contracting is the largest paid circulation monthly magazine in the engineering construction field, and is exceeded only by one weekly magazine in that field.

The net paid circulation of these three monthly magazines has had a great growth during the past 12 months, as shown by the following tabulation:

	July, 1926	July, 1927	Per cent gain
"Engineering and Contracting"	12,124	20,105	66
"Roads and Street"	8,165	10,449	28
"Water Works"	6,071	7,317	20
Total	26,360	37,871	44

Now that a fourth magazine has joined this group, the gross circulation will be not fewer than 75,000 copies monthly.

We shall be glad to send a sample copy of any of our magazines upon request.

The Evolution of Traffic Control

When traffic signal lights were first installed on Fifth Avenue, New York, millions of visitors to the great city were given their first vivid evidence that highway traffic was evolving along the lines of railway traffic, at least in the sense that it required control. It is true that motor vehicles from the very start, moved with the velocity of the average passenger train; but because of their ability to stop quickly and to dodge around obstacles, they had not been regarded as needing any other control than that of the driver, aided by an occasional motor-cop. But when streets became jammed with motor vehicles, it began to dawn on a few men that highway traffic control must be devised.

As we recall it, the signal lights in the towers on Fifth Avenue were still manually operated when another large city—this time one on the Pacific Coast—introduced an extensive system of automatic traffic signals on its streets. In Los Angeles other millions of visitors got their first glimpse of the fast evolution of motor traffic control into something akin to railway traffic control. And there, too, they first heard the expression "jay walker," and some of them first felt the law's heavy hand on their shoulder when they failed to obey the signals. The editor recalls hearing a policeman's whistle about that time, and receiving an admonition to cease "jay walking." He ceased, because $10 was a rather expensive toll to pay for "coming in ahead of the dogs."

Shortly afterward in a small Texas town, the editor again heard a policeman's whistle, but this time he felt sure the summons was not for him, because not a motor vehicle was in sight. True, he was crossing diagonally where Main Street and its principal rival intersected; but it never occurred to him that "jay walking" was banned here. It was, however, and the cop was soon telling him so in forceful if ungrammatical language. "Didn't you see the red light against you? Do you think them lights is put there to look pretty? Or perhaps to guide you home? You don't live here? Well, I'll say you don't. And that's the only reason why I don't arrest you."

And the editor, unused as he was to the ways of big cities and their cops, passed on—but never again diagonally across Main and Seventh. Now it is fast coming about that all of us, whether afoot or awheel, must obey the signal lights. Perhaps a universal use of traffic signals at crossings, coupled with strict enforcement of "jay walking" laws by motor cops, is the best single solution of the problem of reducing motor vehicle accidents. It will cost a pretty penny, yes. Perhaps a few million dollars annually for interest on the investment and operating expenses. But a cent per person annually is only $1,200,000; and who will not favor the expenditure of a good many cents per capita annually, if the dreadful toll of lives can be reduced? Millions seem small indeed when weighed against 20,000 human lives.

H. P. Gillette

Announcement of the Change of Name of This Publishing Company

The name of Engineering and Contracting Publishing Co. has been changed to Gillette Publishing Co. No change of ownership or of publishing policy is involved in the change of name.

This company publishes four monthly magazines, three annual consolidated catalogs, and a group of technical books.

Three of the magazines, Engineering and Contracting, Roads and Streets, and Water Works, are well known to most of our readers. A fourth magazine, Municipal News, has just been added to the group.

Municipal News is the new name of the oldest municipal magazine in America, namely Municipal and County Engineering.

These four magazines will have a combined circulation of not fewer than 75,000 copies monthly, during 1928, distributed thus:

Engineering and Contracting	27,000
Roads and Street	27,000
Water Works	16,000
Municipal News	5,000
Total	75,000

We take this occasion to invite authors to submit manuscripts or outlines of projected technical books that relate to the fields covered by our four magazines.

We shall be glad to send a sample copy of any of our magazines upon request.

GILLETTE PUBLISHING CO.

Our Growing Urban Population

The trend of population in these United States has long been toward the city. Ever increasing earning power on the part of urban industrial workers, together with an over production of farm products, creates for the former a capacity and means of enjoyment of the luxuries of life, while the farm worker lags behind. He is therefore inevitably attracted to the more desirable city life, with its greater earnings, increasing amusements, and the leisure in which to enjoy them.

More fundamental economic factors further influence this trend. Increased wages increase the spending capacity of labor for luxuries. Hand in hand with increased wages goes increased productivity. The possession of luxuries creates a further desire for additional luxuries, and additional income is sought for that purpose through increased productivity. Increasing productivity has been a salient feature of industry. The resultant increased earnings of employees has constantly enforced additional demands upon industry to supply the goods for which wages are spent. This adds further to the production that must be achieved, and thus to the spending power of the workers. Like a snowball, the standard of living of the urban worker grows, and there need be no end to this growth as long as productivity increases.

On the other hand the outlet for farm products is fixed by the population. The adult, whether in town or country, will eat no more food than 4 lb. per day. He may eat less, but seldom more. Hence his demand for food is elastic only insofar as quality is concerned. He may substitute a certain proportion of luxury foods for the cheaper sorts in his menu. His home may range from one squalid room to a palatial residence—or he may reside in an apartment hotel. His wardrobe may include but one suit or a dozen. He may drive the cheapest used car, the latest model of the highest priced make, or none at all. He may operate a crystal set or the most powerful super in captivity. He may attend the theatre once a day or once a year. And so on through all the things that go to make up modern life. But if his health and appetite are normal he will still try to achieve his 4 lb. of food a day, and no more, unless he is mentally deficient.

Thus our population of 118 millions cannot be expected to consume more than about 472 million lb. of food a day. At present our actual productive capacity of food products exceeds this amount. Even the aid given by the export market cannot absorb the balance. With the ever-increasing efficiency with which farming is prosecuted, thanks to our inventors, our Federal government, and our agricultural schools, it is evident that our farm population must continue to diminish relatively to the urban population.

Our growth of population, estimated at 1.6 per cent per annum, does not begin to compare with the estimated increased efficiency and productivity of the farms, amounting to approximately 3 per cent per annum.

At the time of the 1920 census, 77 per cent of our urban population was found in cities of 5,000 population or more, and these towns numbered 1,464 in all. In this connection, the tabulation of population distribution given on this page, based on the 1920 census, is very illuminating. It is to be borne in mind that the same census reported a total population, urban and rural, of approximately 106 million. By means of the increase factor already given, the population of 1927 may be readily estimated to be approximately 118 million. Available statistics and rate of growth computations indicate a relatively greater urban than rural population in 1927 than in 1920, and it is therefore certain that the above percentage figures are somewhat exceeded by this time.

POPULATION (1920)

Incorporated Towns	Number	Population
Over 100,000	65	27,429,326
50,000-100,000	76	5,265,747
25,000- 50,000	143	5,076,041
10,000- 25,000	459	6,942,742
5,000- 10,000	721	4,997,794
Total 5,000 and up	1,467	49,711,650
2,500- 5,000	1,320	4,593,953
Total 2,500 and up	2,787	54,304,603
1,000- 2,500	4,585	
All others	5,533	
Grand total	12,905	64,273,844

Providing for the Traffic

An article in this issue tells how Detroit is providing for the traffic of today and tomorrow by means of a system of wide highways laid out in accordance with actual traffic requirements. Narrow roads and streets must be repaved and widened by many other commuities as well. A study of the Detroit solution would therefore be well worth while, for others can profit by this city's experience.

A Diversity of Paving Around Chicago

Short Survey of Work Shows Various Methods in Use on Street Paving Work in Cook County, Ill., and the Use of Granite Block, Asphalt, and Two Types of Concrete as the Kinds of Pavement Suited to Modern Traffic Conditions

The great modern metropolitan areas such as those including and surrounding Chicago and New York are, and should be, fitting laboratories for the development of municipal paving methods to meet the requirements of changing municipal traffic conditions. What kind of paving work is now being done in the Chicago district? How is it being done? Those are questions that are frequently asked by the highway engineer and contractor from other parts of the country. To obtain the answer, a survey has just been made by ROADS & STREETS which has revealed the following interesting facts. No attempt was made to determine the total mileage of the various types of work on the 1927 program, but representative jobs were visited, all under way at the same time, and the situation at each job observed with care. Of particular interest is the fact that the City of Chicago, in paving streets under the direction of its Board of Local Improvements, is using an unreinforced eight inch or ten inch concrete slab laid in two courses, while an outlying community, in work designed and supervised by a prominent engineering firm, is planning to carry similar traffic on a slab that is a new modification of the Bates section, heavily reinforced, and laid with concrete that is mixed in accordance with the most modern ideas.—The Editor.

While Chicago has, from time to time, used many kinds of paving and her streets display examples of about every paving "period" that the middle west has ever experienced, at present the selection seems to have narrowed down to about three types of work for the majority of the contracts that are now being let. Certain heavy traffic streets, where dray traffic predominates, are paved with granite block on a concrete base. Certain boulevards are being paved with asphalt on a concrete base. Residential and business streets in outlying districts are being paved with two-course concrete. Out in the suburbs, both asphalt and concrete are used, with a predominance of the latter type. Here the concrete is mostly of the more modern one-course type, and in many towns conforms more nearly to state specifications, due to the growing practice in such communities of an engineering firm a member of which was head of the engineering staff of the Illinois State Highway Commission, and who has established himself as a leading authority on highway design and construction. Another factor effecting this choice is the fact that a number of such streets are along state and county roads, and that financial aid from state and county is contingent upon the street being paved so as to meet state or county requirements. One such example is included in this article.

Halsted Street.—Halsted Street is a north-south street a short distance west of the Chicago River and the Loop, and on the west side bisects the Ghetto; scene of the famed and noisome Maxwell Street market. This street carries two tracks of the Chicago Surface Lines, and besides a heavy traffic from this source, must provide for a motor and horse drawn traffic representing about the most severe industrial loading. Steel-tired wheels of the heaviest of horse-drawn drays and the solid rubber tires of the heaviest of trucks provide most of the punishment that the street must bear, since pleasure vehicles account for but a small part of the traffic.

This street is just now being repaved, under the supervision of the Board of Local Improvements, for the City of Chicago, by the contracting firm of John A. McGarry & Co. When the job was visited, the 8 in. base of 1:3:5 concrete was being laid, but according to Henry Fowler, a member of the contracting firm who was found on the job, the street will be further paved with 5 in. granite block with mastic filler. In laying the base, 4-bag dry batches are delivered from the yards of the Chicago Union Lime Works, located at 19th and Lincoln Streets, in two-batch O'Connell "Super" trucks. Twelve of these trucks were devoted to the job, although 14 would have been used if available. A man was stationed at this material yard to supervise the proportioning of the batches and their dispatch to the job, about a mile or so away. Concrete was mixed in Koehring 27-E steam paver, and deposited on the subgrade in the usual manner. A 16-man crew took care of this part of the work, including the operation of the mixer and the shoveling and brooming of the slab. The concrete was mixed at a consistency that required about 24 gal. of water to the batch, or about 6 gal to the sack of cement. This organization averaged about 1,400 cu. yd. of concrete a day on this job. When farther from a material yard, according to Mr. Fowler, they would have their own stock piles, batcher plants, and batch trucks. On this job, the haul from the yard that was prepared to furnish dry prepared batches was so short, he said, that it proved economical to obtain materials in this way, especially since the congested district made stock piling a problem.

The handling of the batch trucks at the mixer was done in an interesting way. The street was being paved in three strips, with two strips always open to traffic, and with the street-car tracks being paved last of all. In delivering the batches, the loaded trucks were backed onto the subgrade and up to the mixer. After the load was dumped, the driver simply changed over

Fig. 1.—Laying the Concrete Base on the Halsted St. Job

to the opposite driving seat of the truck, drove up onto the car tracks, and away to the yard, while the next truck, with the driver in the backing seat, backed up to the mixer with the next batch. The contractor was further represented on this job by C. E. Bradley, Superintendent.

Laramie Avenue.—Far out on the northwest side, Laramie Avenue was being paved with two-course concrete. This work, too, was being done for the Board of Local Improvements, this time by the contracting firm of the Hedges Construction Company. This firm was represented on the job by J. ("Jim") Slattery, foreman, while the City was represented by Ed. J. D. Ryan, inspector. The work under way represented original paving on an old dirt street, and extended from Roscoe Street to Fullerton Avenue, a distance of a little more than a mile, and requiring about 28,000 cu. yd. of concrete. This propect called for an 8 in. two-course concrete slab with expansion joints at 30 ft. intervals, except for a different spacing at alleys and street intersections, together with combined curb and gutter.

Fig. 2.—Grading and Rolling Subgrade on Laramie Ave.

Fig. 3.—Cement and Aggregate Handling on Laramie Ave.

Fig. 4.—The Paving Gang at Work on the Laramie Slab

The grading on this work, done but a short distance ahead of the mixer, was taken care of by a ¾-yard heavy duty Osgood steam shovel, loading direct into heavy trucks for transporting the spoil to the dumps. Directly behind, a Huber 9-ton roller and a Kelly-Springfield (Buffalo-Springfield) 11-ton steam roller prepared the clay subgrade for the slab. Curbs had been set before grading, and the spoil from the curb trenches was thrown onto the ungraded subgrade to be removed by the shovel.

For the paving work, aggregates were delivered by truck to a paved side street near the mixer and dumped onto stock piles. Cement was delivered from the Universal mill at Buffington, Ind., on large trailers. These trailers were allowed to remain on the job until unloaded, serving as loading platforms. Three Barber-Greenes, one for the torpedo sand, one for the No. 9 gravel, and one for the No. 4 granite screenings for the top course, loaded these aggregates into Hug 32½ cu. ft. capacity dump trucks, the cement was then dropped on the load, and the batches then delivered to the paver, running around the block.

A Ransome 27-E paver was used on this job. The mix was a nominal 1:2:3½, mixed in 5-bag batches with about 22 gal. of water to the batch. A 6-in. limestone concrete base was first laid, and this followed by a 2-in. granite topping. Finishing was secured first with a perforated roller, then by long handled floats, and then came a belting. The surface was then checked by a wheeled bridge template, and wet burlap then laid. This burlap was allowed to remain in place for 24 hours, then calcium chloride was applied at the rate of 2 lb. per square yard. If rain occurred within three hours after application, more calcium chloride had to be applied. With this treatment the street could be opened within two weeks during the summer, and within three weeks for work laid after September 1.

The organization required on this job included:

4 graders, pit men
2 roller men
1 shovel operator
1 mixer operator and helper

4 cement hands
3 loader operators
8 trucks and drivers
2 center strip men
2 expansion joint men
2 cement finishers
6 laborers on concrete
2 laborers ahead of mixer
1 mechanic
1 supply truck and driver
2 receiving clerks
1 foreman
2 inspectors

Progress was made on this work at the rate of 900 to 1,300 yards a day. The grading, on which the shovel was served by 4 Macks, meant the removal of about 630 cu. yd. of dirt each day, making an average cut of about 3 ft.

Diversey Boulevard.—This street was being extended westward, and paved with concrete. Since it will later carry a double track line of the Chicago Surface Lines, some provision had to be made to provide for that work. Here the solution was to pave the street in three strips, so that the sreet-car company could later remove the center strip, lay their tracks, and repave at their own expense. Since this street would be expected to carry rather heavy traffic it was designed for a 10 in. two-course pavement, with a 7 in. base and a 3 in. topping. The width was to be 42 ft., and separation was made by means of separation plates and by means of Blaw-Knox road forms. The methods were much the same as on the Laramie Ave. job, except here the grading was finished by means of an Austin blade grader pulled by a Holt 5-ton Caterpillar tractor, and rolled by a 10-ton Buffalo steam roller. A Koehring 27-E paver was used, while dry batches were hauled to the job from a material yard about two miles distant in 2-batch dump trucks. The subgrade was sprinkled just ahead of the concrete to minimize drying out of the slab, tar paper was used to afford separation from the curb and gutter, and a solid roller was used instead of a perforated roller.

This work was being done for the Board of Local Improvements by the Central Paving Company, represented by Al. Peterson, general foreman. The Board was represented by P. J. O'Conner, inspector.

Oak Park Avenue.—The final job of the series being done for the City of Chicago by the Board of Local Improvements, observed that day, was the paving of Oak Park Avenue north of North Avenue. This was an asphalt job, on a concrete base, and binder was being laid when the job was visited. This work, being done by the Contracting & Material Co., represented by Antone Mercurio, superintendent, proved of interest. Here the 2-in. of binder was to be followed by a 1½ in. sheet asphalt top. The binder was delivered to the street in 12 Garford trucks and 1 Sterling, the loads averaging 14,400 lb. A gang of 25 men spread the material, and after it had been in place for a short time it was rolled by two 10-ton Erie and 1 10-ton Chicago rollers. Topping was applied the following day in order to insure better work and a better bond. When paving this 28 ft. roadway, this organization found that it coul lay at least 1,500 lin. ft. per nine hour day, or about 80 loads of top and binder. Mr. Mercurio stated that his company now operates a 600 ton plant, and has no trouble handling a good volume of work. He said that the asphalt used on this job provided for a

Fig. 5.—Another View on Laramie Ave. Showing Finishing Work and Wet Burlap for Curing

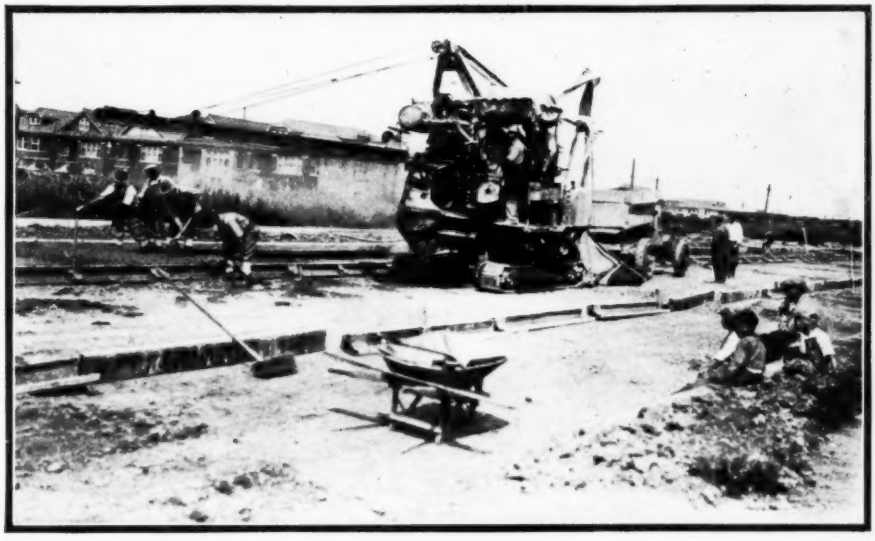


Fig. 6.—Mixing and Placing Concrete on Diversey. Note Strips Separated by Forms, Mixer in Center Strip Paving Right Side

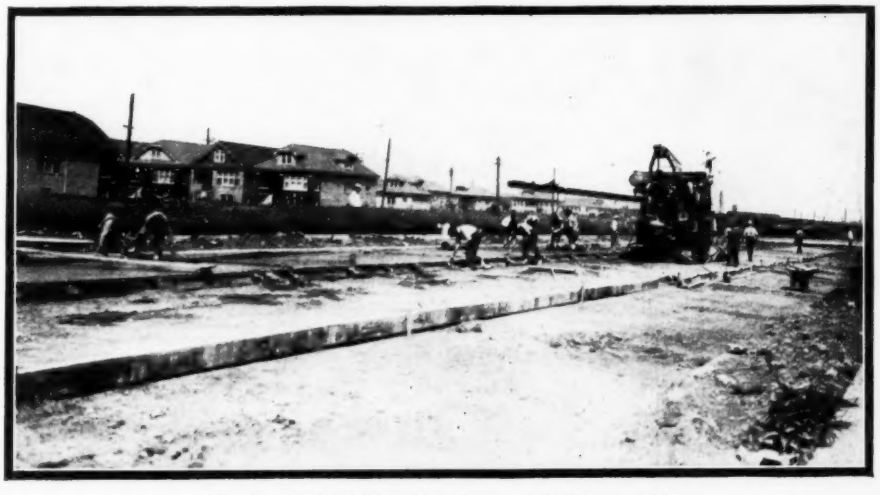


Fig. 7.—The Finishing Operations on the Diversey Job

heavy traffic. He is a firm believer in not rolling too close to the spreading operation, and insists on not putting a topping on a binder that is still hot. On base work, his method is to keep the tampers and broom men well back from the boom of the paver, and to then rebroom the surface so as to give a rougher surface for the binder to key to.

Fig. 8.—Spreading the Binder on Oak Park Ave.

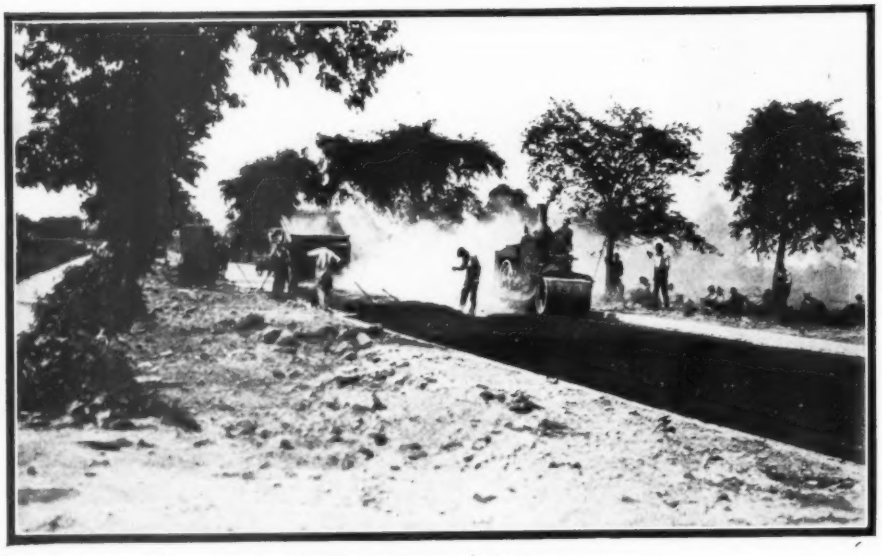


Fig. 9.—Rolling the Binder on the Same Pavement

Fig. 10.—Batch Going Into the Mixer on Oak Park Village Job While Another Is Being Spread

An Oak Park Job.—The Village of Oak Park is a prominent suburb just west of Chicago, and its paving methods are somewhat the same. Here a street just off of North Avenue was seen, where concrete was being laid for an asphalt pavement. This was one of a group of streets being paved in a new subdivision bounded by Ridgland, Oak Park, Euclid, and Edmer Aves., and all concrete was being laid before starting on the asphalt work. Here the work was being done by the contracting firm of W. A. Black & Co., represented by J. J. Martin, superintendent. The village was represented by Martin Thompson, inspector.

This eight inch 1:3:5 concrete base was being laid by a Koehring 27-E paver, with the batches coming dry in a fleet of 18 two-batch trucks of various makes from a material yard 3 miles distant, owned by the Central Lime & Cement Co. The gang included 4 shovel men, 2 broom men, 5 laborers ahead of the paver, and the mixer operator. A wet mix was used. In paving this 28 ft. street, a progress of 1,600 to 1,700 yd. a day was made.

The grading work on this subdivision job was done with two 1-yard Koehring gas shovels and a ½ yard General shovel, followed by a ten-ton roller and an Austin Pup. The asphalt work was done later under separate contract.

An Interesting Job.—A number of interesting new features were found on the paving of that portion of the River Road that runs through the Village of Maywood, a growing suburb west of the Des Plaines River, and some miles west of Oak Park. This portion of this road, which is both a state and county highway, is known as Fifth Ave., and is the original and main business street of the community. On it runs a single track line of the Chicago and West Towns Railways, operators of the suburban street car system. The road, as well as itself being a main north and south highway, acts as a connecting link with several of the main highways leading from the city, and must therefore carry a considerable through traffic as well as a local traffic of some magnitude.

Originally of brick on a topsoil subgrade, and flanked with stone slab curbs, this street is now being paved with reinforced concrete to a greater width than originally provided, all underground work had to be torn up and relaid according to modern requirements, the street lighting system had to be moved back to the new line and replaced, and the old worn out tracks had to be replaced with a new heavy rail section designed for use with the modern pavement. The new track work is designed with the new rail sections placed on wood ties, and resting on crushed limestone ballast. Rails are electrically welded.

Design.—This street is being paved in

accordance with a new design perfected by the engineering firm serving the village. A modification of the Bates Section, this pavement is 9 in. thick except at the shoulders and over the tracks. At the shoulders the thickness is 12 in., tapering to 9 in. at a distance of 3 ft. The slab butts up to the outer side of the nearest rail and is as thick as the height of the rail to the ends of the ties, where the slab is 12 in. thick for a width of 1 ft. The slab then thins out to 9 in. in a distance of 3 ft., with a thickness of 9 in. between this point and the point where the slab begins to thicken to 12 in. 3 ft. from the curb. Between the tracks, which are on the centerline, the thickness is the thickness of the rails. (See Fig. 16).

The main reinforcing is a spot-welded mesh of bars spaced 6 in. on centers, weighing 91.2 lb. per 100 sq. ft. A ⅞ in. shear bar is placed along the edge, while the slab is dowelled to the combined curb and gutter with ¾ in. deformed bars spaced 24 in. on centers. At expansion joints, which are filled with Carey Elastite, ¾ in. slip dowels with tin slip caps on the ends, and oiled, provide continuity of the slabs without interfering with expansion. The design calls for the mesh being carried up to within 2 in. of the rails on each side. Shear bars provide reinforcement between the rails. The tin caps on the slip dowels are made just enough larger than the bars so as to provide an easy sliding fit, and have a lug punched inward at about the mid point to provide for proper placing on the bar during construction. After the pavement is laid and the dowels begin to function, the first expansion shears this lug and the dowels are free to move at will.

While some might suppose that carrying the concrete up to and against the rail might make track maintenance difficult, the engineers are of the opinion that the concrete will prove no more expensive to break out than would well grouted granite block.

Grading.—After removal of old service lines by the corporations and village departments, grading was done with the aid of an Erie ¾ yd. steam shovel, loading into Mack trucks. The old brick were hauled to the village yards but a few blocks away and are to be re-used elsewhere, while other material of no value was taken to the village dumps. This organization could move 200 to 300 yd. of material a day when working with brick, and about 500 yd. a day on dirt. The low performance was mostly due to the fact that the great mass of underground work and existing structures interfered with the grading operation to a great extent.

The Paver.—Dry batches, six bad batches, were delivered in a fleet of 17 two-batch trucks from a material yard in the next suburban town to the west, some 20 blocks away, and dumped into the charging skip of the mixer. The paver used was a Koehring 27-E paver. The batches were proportioned 1:2:3½,

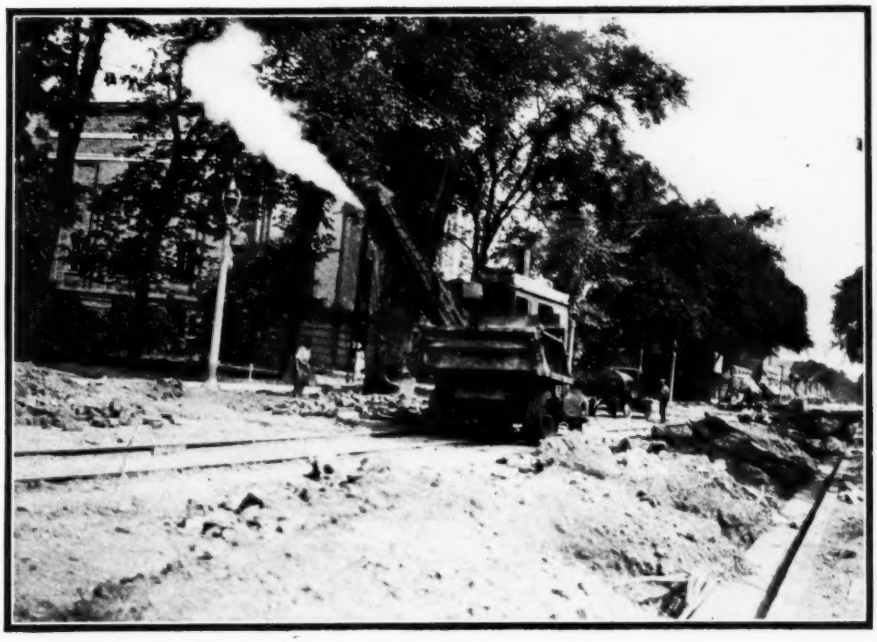


Fig. 11.—Removing the Old Brick Pavement on the Maywood Job

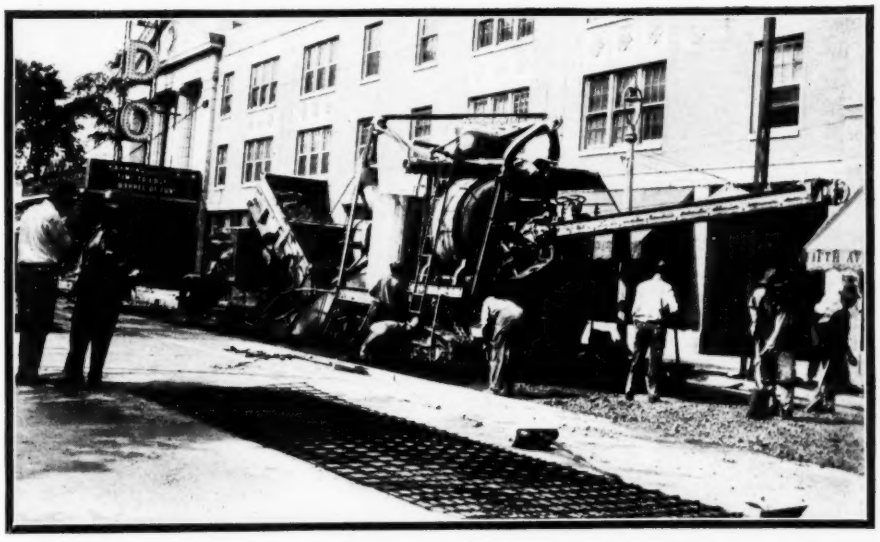


Fig. 12.—A Dry Batch Going Into the Paver on Fifth Ave. While a Mixed Batch Is Being Spread

Fig. 13.—General View of the Finishing Operations on the Same Work

using crushed limestone from a nearby quarry, and mixed as dry as possible, using an average water-cement ratio of 5½ gal. of water to the sack of cement. This gave a mix that showed practically no slump as it came from the bucket, and the shovel men had to use the utmost care to properly embed the steel. The procedure was to first place enough concrete on the subgrade to bring the mesh to the proper elevation, covering an area sufficient to take one sheet of the mesh, and then to lay the mesh on this surface, and then place the rest of the concrete to bring the slab to the desired rough thickness.

Finishing.—A perforated roller was first drawn over the concrete until the surface was properly worked, the slab properly densified, and excess water drawn from the material. Next came a careful floating with a transverse float, then further floating with a longitudinal float, and then after two courses of belting the slab was adjudged finished. The longitudinal float, worked from a square wheeled frame, was used for the purpose of removing waves that would ordinarily make the street bumpy to ride on and lead to impact loads that would impose severe stresses on the slab. Two men on the mixer, 5 shovel men, and 6 finishers, together with the necessary laborers to dress up the subgrade, handle steel, and place the expansion joints, took care of this part of the work.

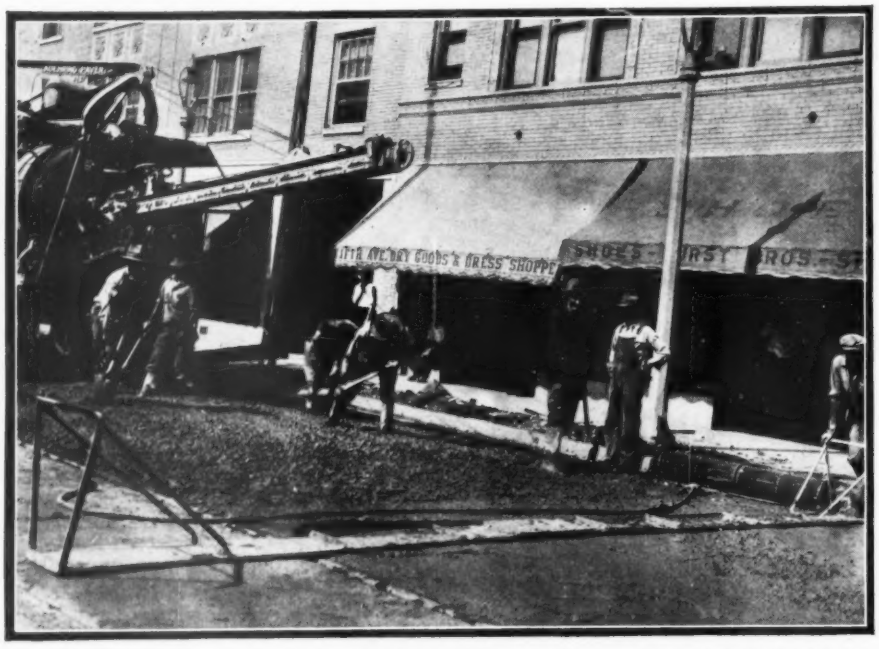


Fig 14.—The Spreading Operation, with the Roller, and the Transverse Float That Are Used

Fig. 15.—The Longitudinal Float and Its Working Frame That Keeps the Men off the Slab

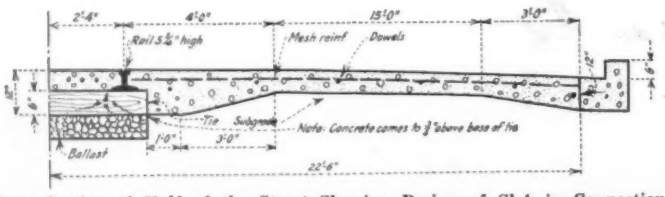


Fig. 16.—Cross Section of Half of the Street Showing Design of Slab in Connection with Car Tracks. A Modification of This Design, Perfected by Mr. Older, Was Used on Another Street Carrying a Double Track Line

Checking the Finish.—An unusual little machine was used on this job to check up on the finished slab for bumps and depressions; used after the slab had secured a good set. This device, invented by District Engineer Lamb of the Illinois State Highway Commission, consists of a main frame with a swivel wheel at each end, plow handles at one end for pushing, and a third vertically moving wheel at the center connecting with a make and break device that shunts an electric current to one of two small bells located on the plow handles. Two 1½ volt dry cells furnish the necessary current, and are mounted on the main frame. When using this device, it is pushed along and across the slab by the inspector. When a depression is encountered, the center wheel lowers into the low spot and makes contact with the lower of the two circuits, ringing one bell. When a bump is found, the wheel raises and closes the other circuit, ringing the other bell. Bells of different tuning make it easy to tell whether it is a bump or depression that has been found. With this device, the inspector can determine the nature of the work much more accurately and with greater speed than with the ordinary straight edge, since the device may be set to register only those departures from the specified limits, and ignore the irregularities that are within the allowed limits. The device is of such a nature that it may be readily improvised on the job.

Other Operations.—For a part of the distance covered by this mile long job the street contains no car tracks. Here the slab was 9 in. thick except for the edges thickened, as already described; 12 in. at the gutter and tapering to 9 in. in 3 ft. Two railroad crossings, one a steam line and one a third-rail electric line, were paved with a hot-mix bituminous macadam.

Those Responsible.—The street was with the cooperation of the Village of Maywood, the State Highway Department, and the County Highway Department, with the state and county paying for 20 ft. and the village paying the remainder by special assessment. The surface lines were not required to do more than lay their own track in a

manner satisfactory to the engineers. The work of grading was done by the Murphy Bros. Teaming Co. of Oak Park, while the paving was done under contract by Jaickes Bros., who were represented on the job by A. F. Klingebiel, foreman. A. V. Baber, acting for the engineering firm of Consoer, Older & Quinlan, was engineer in charge. C. A. Case, who gave this information, is construction engineer for this firm. His firm has been retained as village engineers. J. I. Leach was inspector. State and county were represented on the work by Barney Klinger, county inspector. With these organizations cooperating on the work the paving was progressing at a satisfactory rate when visited, in spite of special difficulties that have constantly interfered.

New Books

Management and Methods in Concrete Highway Construction; by J. L. Harrison, Highway Engineer, U. S. Bureau of Public Roads. Publishers: McGraw-Hill Book Co., Inc., 370 Seventh Avenue, New York City. 242 pages, 74 illustrations, cloth. $3.

Here is a book—we might say handbook—that should fill a long-felt need. It is written for the contractor who seeks better management for the sake of lower costs and better workmanship—written by a man who not only has had a wealth of valuable experience in the field, but who had available the great mass of data that has been collected by the U. S. Bureau of Public Roads.

From start to finish, this book is based upon correct data, sound logic, and mature judgment. It acknowledges the fact that the paving contractor is a business man who must base his bids upon the prevailing market, and who must then so manage his work that it will show an attractive profit regardless of the closeness of the bid. Adequate supervision, according to the author, is required that management may secure the utmost economy in all phases of the work. Sufficient supervisory organization must be afforded in order that the superintendent may devote adequate time and thought to planning every detail of the work and to the elimination of profit leaks.

The book deals with the problems of organization, selection and location of plant, handling the materials, rough and fine grading, and every other element that enters in the work, dicussing the relative merits of alternative methods and equipment from the standpoint of economy and efficiency. The book is arranged in the logical sequence of the planning and the execution of the paving operations. It is concisely written, in clear, easily understood language, and should prove highly valuable to the highway contractor and his superintendents.

Fig. 17.—Placing the Expansion Joint and Slip Dowels. Note How Concrete Covers the Ends of the Ties and Goes Up to the Rails

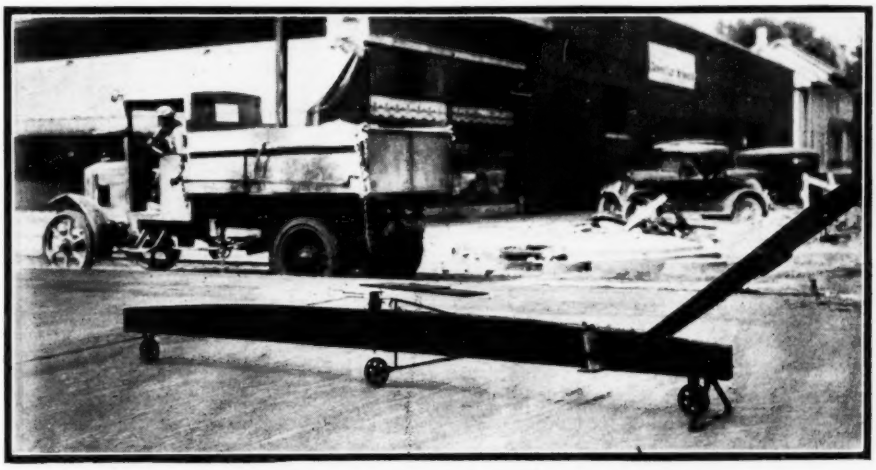


Fig. 18.—This Homemade Instrument Speeded Up Inspection of the Finishing of the Slab

Fig. 19.—General View of Portion of the Street That Contains No Street Car Tracks

Super Highway Plan of Detroit Metropolitan Area

The Need for a Master Plan for Major Thoroughfares Discussed in Paper Presented at 13th Annual Conference on Highway Engineering at University of Michigan

By COL. SIDNEY D. WALDON

I would like to impress upon each of you the urgent necessity of creating plans now for the gradual reshaping of the old horse and buggy standards of street and highway width in your respective districts, in order to more promptly meet the new requirements of the automobile and, in densely populated cities, those of train operated rapid transit as well. Some of you may have already sensed the need, and be actively engaged in this work. My remarks will be mainly addressed to those who have not seen the picture of our changing requirements as clearly as we do here in Detroit.

Briefly I want to show you that the population of this country is increasing at a rapid rate; that automobile ownership is increasing at a more rapid rate than population; that automobile use is going ahead faster than we can provide new facilities to meet the increases in automobile ownership and traffic. I want to show you that the adoption of proper standards and their application to a master plan of major thoroughfares and superhighways, backed up by competent legal and executive authority will make the passage of time an ally of immense power, whereas without a master plan the passage of time becomes an implacable enemy working to defeat our efforts to obtain relief.

Population Tendency.—Let us look at the population tendency of the United States as a whole. The census of 1790 gave a total for this country of 3,930,000. Eighty years later the population had increased to 38½ millions or to almost ten times in eight decades. In 1920 the population was 105,700,000. During those five decades from 1870 to 1920 the lowest increase per decade was 11½ millions and the highest approximately 16 millions.

A press clipping in the January 16th, Sunday Detroit News quotes W. M. Steuart, director of census, and Dr. Joseph A. Hill, chief assistant, as estimating an increase of 18 millions for the present decade 1920 to 1930. Let us be conservative and assume that we will not continue to grow in population at an increasing rate and let us assume that we will not even grow at the figure estimated for the present period but only at an average of 15 millions per decade for the next 70 years. Seven decades at 15 millions per decade is another 105 millions or the equivalent of the entire population of this country as of 1920. It is reasonable to assume that during the span of life of many children born today there will be created a second United States so far as population is concerned, which must be superimposed upon the one in which we now live. Every successive increase in population will bring into being its additional traffic burdens and problems to be added to those that already exist.

What are we doing to plan for the larger requirements of this vastly greater population that is immediately ahead of us?

So much for the tendency of population.

Automobiles—The Medium for Individual Transportation.—Within the past 25 years there has been created a new medium for individual transportation that is working one of the greatest revolutions in man's mode of living that has occurred since the beginning of time. Prior to the coming of the automobile the individual was dependent upon his own efforts, walking or running, or upon the ox or the horse for individual transportation. For eighteen centuries he moved within the limited radius prescribed by these restrictions. Individuals of town and farming communities were isolated from each other for months out of each year by impassable roads.

And now this restriction to individual travel has been banished forever. The farmer's isolation has become a thing of the past. All that the city holds in the way of a market for his produce or for the health, education and recreation of his family is readily accessible to him all the year around. The factory worker, who formerly had to live within sound of the factory whistle, can visit the country at will or live out in the open sunlit places. Given good roads, and the motor car is railroad train and trolley car combined, without their limitations as to fixed routes, stations or time tables. The automobile is rapid transit on rubber tires for the individual.

Increase in Automobile Ownership.—Twenty-five years ago there were less than 15,000 motor vehicles in the United States. Today there are well over 22,000,000. During 1926 the industry produced approximately 4,500,000 motor vehicles or almost 1,000,000 more than were registered in the entire country ten years ago.

In 1920 we had in this country a motor vehicle to each eleven persons. Now we have one to each five persons. In California the ratio is one automobile to each three persons and the tendency of the rest of the states is toward the same or a lower ratio.

The greatest increase in registration occurs in those states already having the largest number. The six states of New York, California, Ohio, Pennsylvania, Illinois and Michigan, added last year 866,000 motor vehicles to the 8,000,000 they previously had, or over 10½ per cent.

So much for automobile ownership which is increasing more rapidly than population and seems to be headed towards at least as low as one motor vehicle to each three persons.

Increase in Use.—In thirteen years Detroit's population has doubled while motor vehicle registrations have increased over ten times. In the same period of traffic counts on Grand River Ave., one of our main trunk line highways, shows an increase of 34 times.

A year ago Wayne County built 55 miles of new concrete roads but in the same twelve months' period registrations in the county increased over 53,000 or almost one thousand vehicles to each mile of new surface. Automobile use is increasing faster than the facilities to take care of it.

Hard surfaces are no longer the only consideration. We must provide wider streets and highways not only to meet the needs of the moment but in order to prepare for the much greater requirements of the future. Improved facilities for transportation invite traffic and benefit most the sections providing the improved conditions.

What of the Future?—If 210 millions of population is possible in this country in another seven decades, and if we are headed toward a ratio at least as low as one motor vehicle to each three persons, then there will be in the neighborhood of seventy millions of motor units trying to find space for travel upon the streets and highways of this country within the scriptural span of three score and ten years, where we are already congested with only 22 millions today.

Remember that we are increasing population, according to the Census Bureau, at a greater rate than 15 millions per decade. But whether we reach these figures in seventy or eighty years is not the important point as much as the fact that we are irresistibly moving toward that objective. What lies beyond we will not now conjecture. It is enough that our civilization will never relinquish the automobile, and both population and automobile ownership and use are bound to grow.

What of Finance?—Twenty-two millions of automobiles last year paid in taxes of all kinds to the city, state and federal governments almost three-quarters of a billion dollars. Seventy mil-

lions of motor vehicles at the same rate would make an annual contribution of 2 1/3 billions of dollars, or more than enough to finance six Panama Canals every year.

Last year Michigan's motor vehicles paid over 27 millions to our state government, or an average of a little less than $25 each. In just about 30 years the normal growth in population and registration will have increased this total to 50 millions annually (or the equal of our recent highway bond issue) to be spent every twelve months by state and county. Within the same seventy-year period Michigan's population will be in the neighborhood of 9 millions, five of which will be in the Detroit area. Michigan's total registrations will be at least three millions. With annual taxes at the same rate there would be 75 millions per year available for road building purposes.

It is perfectly apparent that such increases in population, registration and revenue all lead to the necessity for the most earnest consideration of the very foundation of our highway system, namely, the width of right-of-way, that is, the distance from property line on one side to the property line on the other.

Right-of-Way.—Right-of-way is like the land a manufacturer buys upon which to build his factory. Ninety-nine out of a hundred business men would refuse to make a permanent investment in plant upon a piece of ground only just big enough for immediate needs. Common sense would dictate the acquisition of enough extra land at the original low cost before the building of the plant itself made the adjoining land too valuable to buy for further expansion.

We must lay aside our ox cart and horse and buggy yardsticks of right-of-way width and adopt new ones that fit the motor vehicle. What was an adequate width of street or highway when this country had 38 millions of people and the stage coach was regarded as a flying machine, is obsolete with 100 millions of population that can all be put on rubber tires at one time. These same standards will be hopelessly impossible when we have doubled our present registrations and practically useless when total registrations are trebled.

To make our present plans based solely upon our existing situation without any provision for the future is the extreme of shortsightedness.

Effect of Time.—With population and automobile ownership and use increasing rapidly, changes are continually occurring in the shape of improvements along every main traveled route. Without careful planning, conditions grow steadily from bad to worse. Dead ends, sharp turns, dangerous corners, bad alignments that could easily be remedied in the open country, become tremendously expensive when hemmed in by tall buildings as part of town or city. Ninety-nine per cent of our present traffic troubles exist because in the past no one foresaw the coming of the automobile and few gave a thought to the future, which to us is the present.

A reasonable and forward looking plan once proposed and publicly accepted never dies but continues to attract and inspire its own champions. Time works in its favor and makes accomplishment possible at minimum cost, over a period of years, that would be impossible otherwise. Forethought costs nothing but may be made to save millions in future expense. Wise planning makes time a powerful ally.

Width of Right-of-Way.—The public does not generally understand the difference between width of right-of-way and the width of pavement. They confuse roadway with right-of-way.

A narrow pavement in a wide right-of-way can be increased at any time, but a narrow pavement in a narrow right-of-way, particularly through a thickly built up and congested district is well nigh hopeless.

The foundation of the whole structure of any plan for present and future transportation lies in the standards adopted for the various widths of right-of-way and the subsequent adherence to those standards.

Master Plan.—What is needed in every village, town and city in every township, county and state is a master plan of the main arteries of transportation.

Today no community can afford to consider its situation as separate and distinct from the communities with which it is linked by trunk line highways. The automobile and good roads flood the streets of the remote hamlet with the traffic of a great city.

In our opinion every village in this country should adopt a standard of not less than 120 ft. of right-of-way for the two thoroughfares that intersect at its business center, and should steadfastly work to acquire that width up on its two main streets and upon the section line roads that come within its influence.

120-Ft. Standard.—In thinly settled states or sections where land is cheap, the right-of-way can be made 120 feet just as well as any other width. In the snow belt the wide right-of-way may be the cheapest investment for dropping the drifts far enough from the traveled road surfaces so as to minimize the cost of snow removal. In thickly settled states the traffic will demand wide rights-of-way along all the important main arteries.

The village requires 120 ft. because of the space using automobiles and the need of parking space for its own business without blocking the through travel. The great city requires 120 ft. because it must carry the great bulk of its mass transportation below ground. No opportunity should be lost by the village to acquire the 120-ft. widths as early as possible.

Detroit, the counties of Wayne, Oakland and Macomb, and the contained municipalities, have created and adopted a Master Plan of superhighways and interior thoroughfares.

Superhighways are 204 ft. wide.

Mile section line roads and interior throughfares are 120 ft. wide.

Quarter section roads and secondary streets are 86 ft. wide.

Residence streets are 60 ft. wide.

Automatic Dedication of Right-of-Way.—Adoption by the three counties means that no plats for subdivisions are accepted by the several boards of auditors, that do not provide for dedications of rights-of-way to the standards prescribed along the particular routes affected.

Like the mill of the gods this one provision is automatically and continually grinding out the necessary widths of rights-of-way all over the metropolitan area as our population and traffic grows. Time is working for us and not against us. It is not only saving untold millions of dollars in future condemnation suits, but through establishing a greater potential traffic capacity it is stimulating a more valuable development of the property served and is thereby increasing taxable assets.

Super Highway Commissions.—In addition to this method of the three county boards of auditors, private property owners associations are doing wonderful work along the master plan routes in which they are especially interested. Added to these influences are county and state highway commissions, and a new form of organization created under special act obtained for that purpose, known as superhighway commissions. The latter are created solely for the purpose of acquiring rights-of-way, the improvement of which rests with the road commissions as before.

What has been said about the superhighway portion of the master plan applies particularly to large cities and their suburbs. In principle it is applicable to every village, town, city, county and state in the country. Potentially great cities with heavy motor vehicle registrations demand a network of 204-ft. superhighway rights-of-way, while trunk line routes of major importance across the states should not be less than 120 ft. wide from fence to fence.

Right-of-Way Acreages.—A mile of 66-ft. right-of-way contains 8 acres of land while a mile of 120-ft. right-of-way contains 14½ acres. The difference is 6½ acres per mile. Along one of our trunk line roads the average cost of land purchased at its assessed value for widening the right-of-way was $400 to $500 per mile, and fence replacing cost $700 per mile. The two amounts, together, only approximated 3 per cent of the average pavement cost. There was some additional expense for removing buildings.

Penny Wise, Pound Foolish Policy.—In our opinion it is economically unsound to invest $35- to $40,000 or more,

per mile in hard surfaced roads in a right-of-way of 66 ft. when at so little increased cost it can be brought up to what should become the trunk line road minimum for the entire United States. It should not be less than 120 ft. The pavement invites traffic and enhances the value of the land adjacent and served. Traffic creates business and encourages the erection of buildings which hug the narrow right-of-way. To widen requires the destruction of buildings and the payment of high land prices created by reason of the service given by the pavement. An adequate width of right-of-way should be considered as of just as much importance as the thickness of the concrete or the preparation of the subgrade to receive it.

Right-of-Way Law.—If the wisest thing was done for this country, Congress would pass a law under which no federal aid money would hereafter be spent on any national trunk line highway, the right-of-way of which was below a minimum standard width of 120 ft. Failing this the several states should enact such legislation. The very least that should be done would be for the various states to pass setback laws prohibiting the erection of buildings within 60 ft. of the center line of any concrete or hard surface pavement upon the federal and state trunk line highway systems.

The foundation of the whole structure is the width of right-of-way. The very first operation, therefore, and one that should precede or be coincident with the laying of the first improved road surface should be the acquisition (or reservation by setback lines) of the necessary land to provide for successive widenings of the pavement in keeping with the strategic importance of the route. While laying the pavements to serve the 22 millions of motor vehicles today we must keep in mind the vastly greater needs of the 30, 40, 50 and 70 millions of tomorrow.

Acquiring these rights-of-way will not happen of itself. It must be brought about through the preparation of a logical plan that will not only set up the necessary legislative foundation, but will effectively unite the active interest and support of all the officials best able to carry the plan through to a successful conclusion.

This is no time to spend in vain regrets for what was not done in the past. Let us forget the mistakes and omissions of yesterday. Our forefathers could not foresee the coming of the automobile. But let us keep constantly before us the fact that during the next 70 or 80 years we are going to add another 105 millions to the population of 1920, and another 50 millions to our motor vehicle registrations. Let us remember that only through the adherence to a master plan can our growth be orderly and in proper relation to our growing needs. Let us sink our superhighways as deeply as possible into the outskirts of our great cities, and then work outwards. Let us make 120 ft. the minimum standard right-of-way width for every federal and state trunk line highway in this country.

Let us remember that traffic, and with it development, goes where it is invited and stays where it is well treated. Let us remember that those sections will benefit most that contribute most to the success of the plan. Also let us remember that we can do today simply, as the result of the existence of a logical plan what may cost millions, or be impossible, tomorrow.

The untouched opportunities of the present are almost without limit if we have the vision to see and the will to do.

Highway Research Activities in Minnesota

An interesting summary of the research work now being carried on by the Minnesota State Highway Department is given by F. C. Lang, Engineer of Tests and Inspections, Minnesota Highway Department, in the March Highway Research News, from which we quote as follows:

At the present time the laboratory is carrying on the following investigations in co-operation with other agencies:

1. Effect of tensile strength of cement on the strength of concrete.
2. Standardization of field transverse concrete beam testing machine and method for use.
3. A new method of testing sands using water cement ratio.
4. Use of calcium chloride integrally as an admixture and curing agent.
5. Study of fluid cement water mixtures as a criterion of the concrete making value of Portland cement.

Independently of other agencies we are conducting the following investigations:

1. **Effect of shape and character of aggregate on resulting strength of concrete.** — Compressive and transverse tests are being made, using, under identically the same conditions, a smooth, uncrushed, impervious igneous gravel as coarse aggregate, a crushed limestone, a crushed trap, a commercial gravel containing cracked oversize, and a porous sandstone. The specimens are all broken at 3, 7, and 28 days. Results will be available about April 1, 1927. In these tests the absorption of aggregate is being allowed for in computing water cement ratio.

2. **Frost protection necessary for concrete.**—This investigation was started at the Duluth laboratory last year and is being continued at the same place. Concrete beams are exposed to freezing at different ages and some are repeatedly frozen and thawed. Beams are also cured indoors at two temperatures above freezing point, approximately 40° F. and 70° F.

3. **Durability of paints.** — Approximately two hundred panels have been placed in this exposure test beginning in the spring of 1926. Some results are now conclusive.

4. **Bituminous treatment of gravel roads and earth grades before graveling.**—This we consider the most important and far-reaching investigation that we are carrying on. In this State there is a trunk highway system of approximately 7,000 miles, of which there are about 850 miles paved and over 5,200 miles of gravel. In some localities, gravel is scarce and expensive and its conservation is very important. Some of the gravel roads should and will probably soon be paved as they are carrying very heavy traffic. There still remains a large mileage where the traffic is not heavy enough to justify paving and yet the gravel surfacing is unsatisfactory, both on account of the cost of the gravel and the dust nuisance to motorists and residents along the highway, as well as the inability to maintain a smooth riding surface at all times. The gravel as used in this State contains from 40 to 75 per cent passing a No. 10 sieve, so in many instances there is not much actual metal in the surface. In addition, there is a considerable variation in the quality. It is placed on all kinds of subgrades from heavy clay to granular soils. We are attempting to determine the best materials to use for various conditions of gravel and subgrade. In 1926 we constructed 81 miles of tar on gravel, 66.5 miles of oil on gravel, and 61.5 miles of oil on earth subgrade just previous to graveling. Several different kinds of road oil were used. Careful records of application procedure and maintenance costs are being kept. Bituminous materials and soils are analyzed. This investigation will be continued, with special observation during the spring break-up on heavy soils. The investigation was started in 1924.

Vibrolithic Pavement.—In October, 1921, about 2,200 feet of Vibrolithic pavement was constructed, using different proportions and different kinds of aggregate. In this 2,200 ft. ten different sections were laid. The effect of lean mixtures is now apparent. There has been no maintenance up to the present time except filling cracks.

Concrete Pavements.—Concrete pavements have been under observation for several years. As a result of study and observation we are now constructing contraction joints every 40 ft. 4 in., making the opening clear through the slab and filling the surface where a cap has been removed with bituminous material. Pavements similarly constructed about three years ago with longitudinal joints are practically free from cracks.

Indiana Road School Well Attended.—Over four hundred engineers and officials interested in Indiana's paving work attended the thirteenth annual Purdue road school in La Fayette, Indiana, this year.

Iodization of Public Water Supplies for Prevention of Endemic Goiter

General Discussion Together with Notes on Practical Application and Results Given in the May 20 Public Health Reports

By ROBERT OLESEN
Surgeon, U. S. Public Health Service

The theory that endemic goiter is due principally, if not solely, to a relative or absolute deficiency of iodine is now widely accepted. The experimental evidence upon which this conception is based is so convincing and the practical applications are so successful that doubts concerning the tenability of the theory are steadily being dispelled.

Following the convincing demonstrations of Marine and his colleagues in preventing goiter among children and lower animals through the administration of small amounts of iodine, public health officials promptly turned their attention to the important matter of applying this new and effective weapon against a disease of long standing. However, in emulating the examples of these pioneer investigators it became apparent that successful prophylaxis is dependent upon the rigid observance of certain well defined and fundamental principles. These requisites for preventing endemic goiter may be stated as follows:

1. Minute dosage of iodine.
2. Palatability of the preparation used.
3. Efficiency.
4. Harmlessness.
5. Low cost.
6. Wide range and ease of administration.

Goiter Prophylaxis Versus Treatment.—There is an unfortunate, as well as rather general, misconception of the distinction between goiter prevention and goiter treatment. To many persons the measures advocated for prophylaxis are regarded as being equally efficacious in the treatment of goiter. This erroneous belief is also entertained by many physicians, their goitrous patients being advised to partake of iodized salt or water in order to obtain relief from thyroid disease. Because of the confusion surrounding the subject, it is believed to be advisable to restate the conditions and expectations of goiter prophylaxis.

Prophylactic doses of iodine are intended solely, of course, for the maintenance of the equilibrium of the normal thyroid. The minute doses of iodine suitable for prophylactic purposes probably have little, if any, effect upon existing thyroid enlargements. If goitrous manifestations are reduced or entirely relieved while prophylactic measures are applied, the results may be regarded as incidental rather than usual.

The treatment of existing goiters is a matter entirely removed from the realm of prophylaxis. Treatment requires, first of all, the services of a physician with special skill and experience, particularly in the diagnosis of the different forms of goiter. Furthermore, the medical attendant must possess a keen appreciation of the poisonous potentialities of iodine. As the usefulness of iodine in treating goiter is definitely limited, the possibilities of causing irreparable damage through the use of this element must be thoroughly realized. Needless to say, the breach between goiter prophylaxis and treatment is a wide one. When the essential differences are more generally understood, both preventive and curative measures will be placed upon a more secure basis.

Water and Salt as Mediums for Conveying Iodine.—Inasmuch as the form in which iodine is conveyed to those in need of the prophylactic is apparently immaterial, numerous preparations, combinations, and methods have been proposed. However, from a practical standpoint it is essential that the iodine be administered in palatable form to all in need of it and with a minimum of administrative supervision. With these objectives in view, investigators began the search for a medium in which iodine could be conveniently distributed.

Water and salt, being the most frequently used articles of food, were naturally chosen early as suitable vehicles for the general distribution of iodine. Iodized table salt is now extensively used in some sections of the United States and Europe, particularly in Switzerland, Austria, and Italy. While the reports as to its efficiency and harmlessness are not in harmonious agreement, nevertheless iodized table salt may be considered a prophylactic of considerable promise, especially after the iodine content has been scientifically adjusted.

When McClendon and Hathaway announced, in 1924, the apparent existence of an inverse ratio between the incidence of endemic goiter and the amount of iodine in the drinking water of a given community, interest in goiter prophylaxis was still further increased. In view of the close relationship presumably existing between goiter and the amount of iodine in water, it was but natural that attention should be directed to the possibility of utilizing artificially treated water in preventing simple goiter.

It appears that Dr. G. W. Goler, health officer, in cooperation with Mr. B. C. Little, superintendent of the waterworks bureau of Rochester, N. Y., were the first to propose, and actually put into effect, the iodization of a public water supply for the prevention of simple goiter. Since that time several cities in the United States and England have instituted the same procedure. In the following discussion will be considered the various angles of the subject.

Quantity of Iodine Required for Prophylaxis.—Much of the objection which has arisen to the use of iodized water in preventing simple goiter is due to the difficulty in establishing and maintaining a suitable iodine content. Iodine must, of course, be present in sufficient quantity to satisfy the thyroid requirements and, at the same time, be incapable of inflicting damage upon the glands of hypersusceptible individuals. McClendon, after a number of years of intensive research, has concluded that the iodization of water supplies in goitrous sections is an acceptable and efficient means of supplying needed iodine. He believes that 0.01 milligram of iodine daily is sufficient for physiological requirements and, hence, is prophylactic in character. One-tenth of a pound of sodium iodide per million gallons of water would, in McClendon's opinion, be ample for the maintenance of thyroid equilibrium. Water so treated would contain 1 part of sodium iodide in about 100,000,000 parts of water. McClendon believes that the iodide may be supplied continuously or intermittently, the iodide being proportionately increased when the latter method is followed. By following these suggestions it is theoretically possible, at least, to have a proportion of 10 parts of sodium iodide to 1,000,000,000 parts of water. McClendon regards a region as amply supplied with iodine when the water contains 5 or more parts of iodine per 1,000,000,000 gallons. This line of demarkation between iodine rich and iodine poor water supplies may, in the absence of an established standard, be used as a point of departure in deciding whether the procedure is justified.

Iodization in Rochester, N. Y.—As iodization of drinking water has been carried out more scientifically in Rochester, N. Y., than elsewhere, the methods adopted in that city are of particu-

lar interest. Iodization was begun in Rochester in April, 1923, and has been continued twice a year since that time. The experience gained with the early iodization has resulted in considerable improvement and satisfaction with the later methods. At present there are 21 applications of sodium iodide twice a year ,each of 16.6 lb., the first in May and June, the second during October and November. The applications of sodium iodide are now made as follows: During the first week the salt is added daily. Thereafter the additions are made every other day until 21 have been completed. By this means a concentration of iodine ranging between 14 and 28 parts per billion is insured for a period of nearly five weeks. The results of daily iodine determinations made during three of the periods of iodization are shown graphically in Fig. 1. From the actual analyses of the water it is estimated that each person in Rochester ingests 3.1 milligrams of iodine in one year. This amount coincides rather closely with the annual quantity of iodine, 3.65 milligrams, recommended by McClendon.

In calculating the quantity of iodine present in water after treatment with an iodide it is necessary to remember that the element iodine is only a portion of the compound ordinarily used. Thus, the percentage of iodine in sodium iodide is approximately 85 per cent. Therefore, in estimating the parts per billion of iodine present in water, the calculations, in the instance of sodium iodide, must be made upon the basis of percentage composition.

Per Capita Water Consumption and Iodine Dosage.—In the absence of accurate knowledge as to the average per capita consumption of water, it is obvious that the amount of iodine ingested from an iodized supply is uncertain. Ordinarily, it is estimated that two quarts of liquid are consumed each day by the average person, one-half of this amount being water, while the remainder is fluid in coffee, tea, and other beverages. Probably an additional quart of liquid per capita is used in cooking, thereby affording another source of iodide.

If each person in need of prophylaxis consumed definite quantities of iodized water and the amount of iodide was sufficient to insure results, this method of supplying the needed element could be relied upon to achieve results. Unfortunately, the consumption of water varies within a wide range, some individuals drinking considerable water while others use relatively small quantities. However, the amount of iodine present in properly treated water is so minute that no harm could possibly result from an excessive consumption of water. On the other hand, it is conceivable that these same minute doses of iodine will prevent simple enlargement of the thyroid gland. At the same time, it must be conceded that the iodine obtained from treated water is likely to be uncertain in quantity.

Objections to the Use of Iodized Water.—The objections raised against the use of iodized drinking water as a means of preventing endemic goiter have been numerous. The strongest disapproval has come from the group which discredits all attempts of scientific medicine to minimize the prevalence of disease. Iodization of drinking water is termed by them a "doping" or poisoning process. In view of the minute quantities of iodide used, and the scientific premise on which the procedure is based, the objections of an organized minority may be somewhat discounted. There are, however, certain apparently legitimate objections which deserve consideration. Among these may be mentioned the possibility of inaugurating toxicity in apparently benign goiters, excessive cost, waste, offensive taste, undesirable chemical combinations, and the like. Each of these objections may be considered separately.

Cost of Iodizing Public Water Supplies.—The cost of a public health measure is an item of obvious concern to administrators and taxpayers. It is manifest that goiter prevention should be allotted a fair proportion of public funds commensurate with its relative importance. Heretofore, estimates of the cost of iodizing public water supplies have varied within wide limits. However, the actual expenditures incurred by the city of Rochester for this purpose apparently form a reasonable point of departure for other calculations. Rochester spends approximately $3,000 a year in iodizing its water. As the city has a population of 300,000, the annual per capita cost of the procedure is 1 cent. The sodium iodide used for treating the water costs about $4.30 a pound, delivered in Rochester.

Anaconda, Mont., is another city in which iodization of the public water supply is being practiced. The annual expenditure for sodium iodide in this city is $600, or approximately $0.05 per capita, the sodium iodide costing $4.75 per pound f. o. b.

Kimball estimates that it would cost the city of Cleveland $125,000 a year to iodize the drinking water. The health officials of Chicago estimate that $57,120 a year would be required to increase the iodine content of Lake Michigan water to one-seventy-fifth grain per gallon. With sodium iodide costing $3.75 a pound, delivered, Mellen estimated that the water supply of Minneapolis, Minn., could be iodized at a total annual cost of $6,500, or a cent and a half per person. The cost in Duluth, Minn., would be less than $2,000 a year.

Bolt and Wolman have prepared an informative summary of costs, shown in Table I, based upon the expenditures in Rochester, N. Y., and Sault Ste. Marie, Mich., and the estimates of Ellms for Cleveland and of Bahlman for Cincinnati.

The costs in this table are based upon the assumption that the quantities of sodium iodide used will be sufficient to secure a content of 75 parts of iodine per billion gallons of water.[1] However, in all probability a greater amount of sodium iodide, and consequently larger expenditures, would be required to secure this concentration. Most of the estimates which have been given indicate that the expense attached to iodization of public water supplies is reasonable, provided, of course, favorable results are forthcoming.

Waste.—To many persons the iodization of a public water supply appears to be a wasteful, and consequently an unnecessary costly, method of conveying iodine to those in need of it. Inasmuch as less than one-half of 1 per cent of a water supply is used for drinking and cooking purposes, there would seem to be justification for the charge that most of the water is unnecessarily iodized. Obviously, nearly all of any water supply is used for sanitary purposes, laundering, boilers, street flushing, automobile washing, and numerous other purposes unassociated with disease prevention.

However, the same objections may reasonably be raised with regard to other methods of water improvement. The safeguarding of water supplies by filtration and chemical treatment is so well established as to be accepted as a necessity rather than an esthetic refinement or luxury. Thus, raw water sup-

Table I.—Estimated cost of iodization of public water supplies in 4 cities in the United States

City	Population, 1920	Average Pumpage per day	Amount NaI per day	Cost NaI per lb.	Cost per year, 3 weeks' dosage twice a year	NaI in the water	Cost per capita year (approximate)
		M. g.	Lbs.			P. p. b.	Cts.
Rochester, N. Y.	295,750	25	16.6	$4.35	$3,032.82	75	1.0
Sault Ste. Marie, Mich.	12,096	3	2	4.35	365.40	75	3.0
Cleveland, O.	796,841	150	100	4.35	[1]12,180	75	1.5
					[2]18,270		2.3
Cincinnati, O.	401,247	56	37	4.35	[1]4,506.60	75	1.1
					[2]6,759.90	75	1.6

[1] 2 weeks. [2] 3 weeks.

[1] It will be noted that there is a marked difference between the 5 parts of iodine per billion gallons of water regarded as sufficient by McClendon and the 75 parts per billion gallons upon which the cost data presented here are calculated. These estimates were, of course, made by different observers. Obviously, the proper amount of iodine to be conveyed in drinking water for prophylactic purposes is not definitely known. If, as McClendon contends, 5 parts of iodine per billion gallons of water is adequate, the cost of iodizing drinking water would be materially less than the amounts given in the table. It may also be pointed out that the Rochester experiment shows that the amount of iodine recoverable from water after the addition of sodium iodide is much less than the quantity added.

plies are subjected to coagulation, sedimentation, filtration, and disinfection, all expensive processes, in order that the fluid may be made safe for human consumption. Lime, alum, and chlorine are widely used in connection with such water treatment. For softening hard water, lime and soda are frequently employed, while copper sulphate is used as an algicidal agent. None of the water supplies treated with the chemicals just mentioned are now regarded as drugged, medicated, or doped. Quite on the contrary, the processes are generally conceded to be necessary for the safeguarding of comfort and health, even though only a comparatively small quantity of the water is actually consumed. Moreover, present day opposition to the chemical treatment of polluted or unsuitable raw waters is insignificant, permitting the steady extension of protective measures, with consequent lessening of water-borne diseases.

Reaction Between Iodine and Chlorine.—In discussing the iodization of water before the Ohio Conference on Water Purification in 1924, Ellms intimated that an undesirable chemical reaction occurred between the iodine and the chlorine, so commonly used for disinfection. Although his observation lacks confirmation, Ellms contended that chlorine has a tendency to decompose sodium iodide and liberate iodine. While the element would not be lost, its combination with organic matter, or reaction with other normal constituents, might adversely affect its prophylactic value. No objection of similar character has been noted in the literature.

Taste.—Much greater quantities of iodine than those ordinarily recommended could be placed in drinking water without imparting a detectable taste. Mellen, for example, states that he has drunk water containing one thousand times the amount of iodide proposed for Minneapolis (10 parts per billion), without being able to detect the taste. It is known, too, that individuals going from a district having water with a low iodine content to another locality with a high iodine content do not complain of an offensive taste. Moreover, there is no record of damage having been inflicted upon the thyroid by reason of removal from a district with low iodine content to one with a high content.

Hyperthyroidism.—The possibility of stimulating an apparently quiescent thyroid gland to hyperactivity and toxicity through the use of iodine is a contingency particularly to be guarded against while employing prophylactic measures. However, it is difficult to understand how the minute quantities of iodine available in iodized drinking water could exert such a detrimental effect. It would seem more reasonable to question the ability of the measure to exert any beneficial influence upon the normal thyroid gland. However, as there is convincing evidence that minute doses of iodine, in other combinations, aid in maintaining the thyroid equilibrium, it is likely that iodized water will, under fair conditions, do likewise.

No instances of hyperthyroidism following the use of iodized drinking water appear to have been recorded. The opinion of Dr. C. H. Mayo, concerning the harmlessness of iodized water, is typical of many expressions from physicians who have considered the matter. Doctor Mayo has said, in a communication addressed to the health commissioner of Minneapolis, "As there is no type of goiter which would be injured by the small amount of iodine obtained from the water, I do not believe there would be any risk whatever in such cases."

lets once a week for 30 weeks during the school year. Iodization was practiced for a short time in Sault Ste. Marie, Mich., and Virginia, Minn., but was speedily abandoned because of numerous objections from residents.

The health and water works officials of Minneapolis, Minn., have repeatedly advocated iodization of the public water supply. Moreover, preparations were made to put the procedure into effect. Owing, however, to many objections the project never materialized. In Duluth, Minn., the water and light department of the division of public utilities, has been very active in advocating iodization of the water. According to the investigations made by McClendon, the Duluth water contains the least amount of iodine of any locality in the United States. However, objections

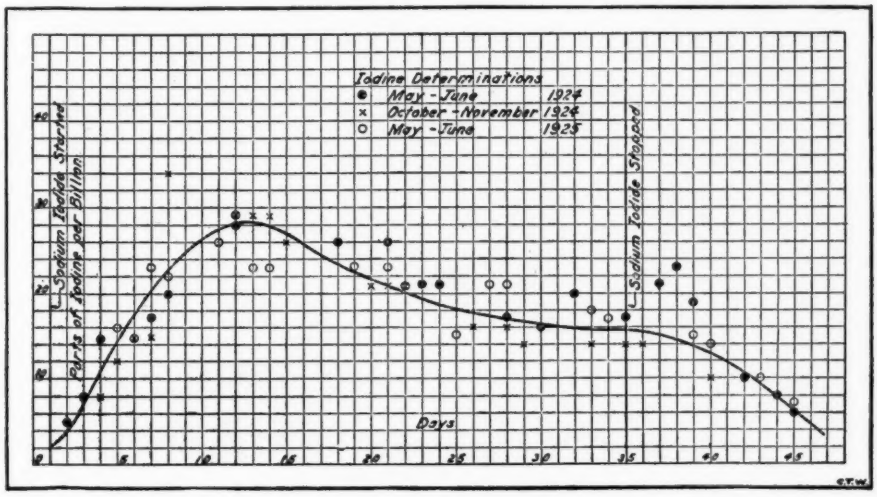


Fig. 1.—Results of Daily Iodine Determinations Made on Iodized Drinking Water at Rochester, N. Y., During Three Periods of Iodization, May-June, 1924, October-November, 1924, and May-June, 1925

On the other hand it can not be denied that some physicians are apprehensive lest the "promiscuous distribution of iodine," as they term it, to those not in need of the element, cause a marked increase in hyperthyroidism. Manifestly, there is need for accurate information on this point.

Cities Using Iodized Water.—So far as can be learned from correspondence with all of the State, county, and city health officers (the last named in cities having populations in excess of 10,000) in the United States there are only two places in which iodization of drinking water is now practiced, Rochester, N. Y., and Anaconda, Mont. Iodization of the Rochester water supply began in April 24, 1923, and will be continued according to an announcement in the Rochester health bulletin of May, 1926, "until, through education or in some other way, we get the people to consume iodized salt."

Iodization of the Anaconda, Mont., water supply began in April, 1925, and was continued in October, 1925, April, 1926, and October, 1926. Children in the Anaconda schools are also receiving 10 milligram chocolate-iodine tab-

have prevented the inauguration of the measure.

In the county of Derbyshire, England, iodization of drinking water was practiced on a limited scale during 1925, the results being reported by the school medical officer. According to J. A. Goodfellow, the water supplies of Ilkeston and Heanor are being treated with sodium iodide. In these last-named places the iodization is continuous, 2 lb. of sodium iodide being added weekly.

Method of Adding Iodide to Water.—Owing to the readiness with which sodium and potassium iodide dissolve in water, no difficulty has attended the introduction of these salts in large public supplies. In Rochester the weighed amount of sodium iodide is placed in a bag and allowed to dissolve in the swiftly running water entering Rush Reservoir from Hemlock Lake. That the salt is disseminated throughout the reservoir is attested by the uniform iodine content of water from widely separated city taps. Apparently no special apparatus or means for insuring even distribution of iodine in a water supply are required.

Alleged Collateral Benefits of Iodized Water.—Quite aside from the beneficient influence presumably exerted upon the normal thyroid gland through the use of iodized water, may be mentioned the advantages possibly accuring in other directions. In extolling the cause of iodized water, the Water and Light Department of Duluth, Minn., makes he following statement (Bulletin 43, issued in April, 1926):

Everyone drinks water every day, uses it to water his garden, sprinkle his lawn, lay the dust in the street in front of his house, washes his floors, his clothes, his face and hands, and even bathes in it. If iodized and used on the garden it gives the vegetables and fruits their proper proportion of iodine. Some of it is evaporated into the air where it combats dust carriers of infection. Iodized water for the dairy herds helps to iodize the milk. It is beneficial, even if breathed into the lungs. However, most of it is washed into the sewers, where it is carried out into the lake, where it prevents goiter in our food fishes. None of the iodine is actually wasted or lost.

Whether, with out present incomplete knowledge of the subject, this enthusiastic view is justified, can only be conjectured.

Results.—The chief difficulty in appraising the efficiency of iodized water as a goiter prophylactic arises from lack of clear-cut statistical evidence. In most communities in which goiter is present to an extent sufficient to warrant the institution of prophylactic measures, iodine is available in several forms. In addition to iodized salt, iodine of some other form may be prescribed by the family physician. When the drinking water is also iodized, it is of course, difficult to decide which of the several measures deserves credit for changes in goiter incidence.

According to the health authorities in Anaconda, Mont., endemic goiter is less prevalent than before prophylaxis was inaugurated. However, no accurate figures supporting this impression appear to be available. Owing to the fact that both iodized water and iodine tablets are being used by the school children, it is impossible to ascribe the lessened incidence definitely to either of the two methods.

The health authorities of Rochester, N. Y., claim a reduction in goiter incidence following the iodization of the public water supply. In 1923 there were 3,844 children with visible thyroid enlargements; in 1924, there were 1,766; and in 1925, 2,010. While there has apparently been a decrease in the number of instances of goiter observed, the testimony would be more convincing if percentages based upon the total annual numbers of children of each sex examined were available. Inasmuch as the use of iodized table salt has been recommended in Rochester, it is questionable whether any reduction in goiter incidence may be ascribed solely to the iodization of drinking water.

Derbyshire, England.—According to Ash, goiter increased among the boys and girls of four schools in Derbyshire County, England, following iodine prophylaxis. The experiments lasted approximately 10 months each, and included the use of iodized water alone, iodized tablets alone, and combinations of the two measures. In each instance Ash recorded a decided increase in the amount of goiter at the second examination. The results of the Derbyshire experiments have been arranged in tabular form in Table II.

Conclusions.—The iodization of public water supplies, in its present state of development, can not be recommended for widespread adoption. However, the measure appears to be theoretically sound and promising as a means of reducing goiter incidence when correctly used. The chief points in its favor are its comparatively low per capita cost, its apparent harmlessness even to existing goiters, and its wide range of applicability.

Table II.—The Effects of One Year's Use of Iodized Drinking Water and Iodized Tablets Upon the Thyroids of the Pupils in Four Schools in the County of Derbyshire, England

School	Time of examination, 1925	Iodine supplied in—	Ages	Sex	Number examine	Number of goiters	Per cent of goiters
1	Feb. 26	Tablets and water	9-14	Female	306	75	24.5
	Dec. 10				287	192	66.9
2	Feb. 27	Water only	5-10	do	108	32	29.6
	Dec. 11				118	50	42.3
	Feb. 27		5-7	Male	59	11	18.6
	Dec. 11				50	13	26.0
3	Febrauary	Tablets only during first half year.	7-14	Female	271	127	46.8
	January, 1926	Water only, during second half year.			283	146	51.5
4	March	Tablets only during second half of year	10-18	do	151	62	41.3
	December				131	85	64.8

An increase in the prevalence of goiter among children following the use of iodine is most unusual and no similar incident has been recorded in the United States. As the numbers of children included in the experiments were small, and no parallel control groups were studied, the validity of the conclusions may be questioned. Iodized water alone was used in only one of the four experiments.

The results of the experiments in which both iodized water and iodized tablets, or iodized sweets, as Ash calls them, were used, are an indictment of iodine prophylaxis rather than the methods employed. It is felt that the time during which the experiments were carried on was too short to permit of an accurate appraisal of either of the methods employed. It would be interesting to learn something of the status of the several groups one year after the complete withdrawal of iodine.

Opinions of Health Officers Concerning Iodized Water.—The proposal that endemic goiter be prevented through the medium of drinking water has created widespread interest. Health officers, especially, have manifested marked interest in the possibilities of the measure. In an effort to learn the attitude of county and city health officers toward iodized water, a questionnaire was addressed to 1,040 workers of this type in the United States. The replies, received from 56.3 per cent of this group indicate an uncertainty concerning both the justifiability and efficiency of treating drinking water with iodine. The answers received from 566 health officers may be tabulated as follows.

Favorable to use of iodized water	159, or 28 per cent
Undecided	105, or 18.5 per cent
No opinion	202, or 35.7 per cent
Opposed to measure	100, or 17.7 per cent
Total	566

So far, there is considerable doubt as to the ability of iodized water to reduce the incidence of endemic goiter. This important point should be clearly established before further commendation of the measure can be forthcoming. However, the lack of convincing evidence of the efficiency of iodized water appears to be the result of poorly controlled experimental applications, rather than any inherent defect of the procedure itself.

While the measure can not be recommended for wider use until stronger evidence concerning its value is forthcoming, nevertheless, iodized water should not be condemned as worthless. Rather there is need for more precise experimental work, with careful and repeated thyroid examinations, both of children as well as adults. Comprehensive control experiments in nearby communities, among groups which are not consuming iodized water, are also essential. In conjunction with these precautions, it is also desirable that epidemiological observations be made for the purpose of learning whether other iodine preparations are being used. The results of such scientifically performed experiments would readily disclose the worth or worthlessness of iodized drinking water as a means of preventing simple goiter.

Conquest of Typhoid.—For the first time in 15 years that the records of typhoid fever control in the large cities of the United States have been published, four cities went through the year without a death from this disease and in more than a dozen others the rates were under 1.0 per 100,000 population, says Hygeia. The number of cases was probably 50,000 less in 1926 than it would have been if the conditions of 1900 had continued to prevail.

Tests of Fine Aggregate for Concrete

Use of Lumnite Cement for Short Time Tests to Determine Quality Described in Paper Presented June 22 at 30th Annual Meeting American Society for Testing Materials

By SANFORD E. THOMPSON and MILES N. CLAIR

President, The Thompson & Lichtner Co., Boston, Mass.; Construction Engineer, The Thompson & Lichtner Co.

The large amount of information being made available concerning the various factors affecting the quality of concrete is making engineers realize that many items previously given but slight attention are of vital importance from the standpoint of economy and durability.

This interest in quality control is reflected in the more general use in specifications of the requirement that materials be subjected to complete laboratory examination preliminary to their use on the job. The period between the date of the signing of the contract for construction and the time the materials are required for the first concrete is often a matter of only a few weeks. If the time required to collect the samples of materials to get them to the testing laboratory is considered, it is obvious that time available for the tests is usually a matter of a few days. Most of the present standard tests of materials entering into concrete require from 7 to 28 days before a definite rejection or acceptance can be made. The result is, generally, that either the material is used without awaiting the results of the laboratory examination or the job is held up.

Various organizations have developed certain tests to enable them to identify within a very short time those materials definitely satisfactory or definitely unsatisfactory. The 1-day neat test gives a good indication when information is desired within a short time on a particular lot of cement. Likewise, a 3-day tension test of mortar briquets has been used to supplement the standard 7 and 28-day mortar test for fine aggregates.

A 24-Hour Test.—This paper was prepared to bring to the attention of those who have to do with the testing and selection of fine aggregates for concrete, data from the use in commercial testing practice of a mortar-strength briquet test made at 24 hours using Lumnite cement. There will be given a short statement of the method of making this test, a tabulation of data for comparison of the Lumnite tests with the portland-cement mortar tests at 3, 7 and 28 days, and a brief discussion of these data.

The demand for quick information in regard to the quality of fine aggregate led the organization with which the authors are connected to experiment with and adopt the 3-day portland-cement mortar test, about six years ago, to supplement the usual 7 and 28-day tests. Preliminary experiments showed that three days was about the shortest period that could be used to give consistent results. The tests were made in accordance with the A. S. T. M. standards except that an extra set of the briquets was made up for test at three days. However, three days was too long a period in many cases, and, therefore, rather than base a preliminary rejection or acceptance on the information given by the usual examination and chemical tests alone, experimentation was started on a 24-hour test. The preliminary tests with Lumnite cement showed that it gave results that were reasonably concordant with those obtained by the standard method and so about the middle of 1925 the 3-day portland-cement test was discarded and a 1-day Lumnite-cement test

Table I—Results of Tests on Fine Aggregate, Including Both Lumnite and Portland Cement Tests

Test	Source of Fine Aggregate	Fineness Modulus	Silt, per cent	Organic Matter, parts per million of tannic acid	Strength Ratio			Remarks
					Lumnite Cement	Portland Cement		
					24 Hours	7 Days	28 Days	
No. 1	Eastern Massachusetts	2.95	0.5	none	138	145	140	Bank sand.
No. 2	Western Massachusetts	3.40	0.86	none	137	139	136	Lacking in fines. Bank sand.
No. 3	Eastern Massachusetts	3.07	2.5	20	161	167	158	Bank sand.
No. 4	Western Massachusetts	3.93	2.8	500	158	151	149	Bank sand.
No. 5	Eastern Massachusetts	3.23	1.8	none	146	137	123	Bank sand.
No. 6	Western Massachusetts	3.16	4.0	20	131	124	128	Bank sand. Excess of material passing No. 100 sieve.
No. 7	Eastern Massachusetts	3.87	2.5	100	134	140	127	Bank sand.
No. 8	Eastern Massachusetts	2.45	0.8	20	104	100	102	High in fine material. Bank sand.
No. 9	Eastern Massachusetts	2.25	2.1	100	110	105	100	Bank sand.
No. 10	Eastern Massachusetts	2.26	3.5	20	127	100	100	Bank sand.
No. 11	Eastern Massachusetts	2.72	3.0	20	115	111	115	River sand.
No. 12	Central Massachusetts	3.24	0.3	20	97	99	89	Bank sand.
No. 13	Central Massachusetts	2.18	2.6	250	87	82	83	Bank sand. Excessive fines.
No. 14	Eastern Massachusetts	3.00	2.8	none	135	154	155	Bank sand.
No. 15	Western Massachusetts	2.89	8.0	100	85	81	98	Bank sand.
No. 16	Western Massachusetts	2.25	4.4	20	96	114	117	Excess fines. Bank sand.
No. 17	Western Massachusetts	2.84	4.0	20	135	108	122	Excess fines. Bank sand.
No. 18	Western Massachusetts	3.16	5.0	20	106	111	115	Excess fines. Bank sand.
No. 19	Eastern Massachusetts	2.37	1.2	100	112	105	100	Bank sand.
No. 20	Eastern Massachusetts	....	...	20	114	108	97	Bank sand.
No. 21	Eastern Massachusetts	....	...	20	101	108	97	Bank sand.
No. 22	Eastern Massachusetts	2.44	1.0	none	118	116	120	Bank sand.
No. 23	Eastern Massachusetts	2.62	7.0	250	129	132	129	Excess fines. Bank sand.
No. 24	Eastern Massachusetts	3.23	1.0	20	131	141	119	Irregular. Bank sand.
No. 25	Central Connecticut	2.47	0.5	20	104	97	88	Poor. Bank sand.
No. 26	Central Connecticut	2.57	3.0	250	114	103	101	Bank sand.
No. 27	Maine	1.88	...	none	118	113	116	Passable. Bank sand.
No. 28	Central Maine	2.40	1.5	20	100	114	113	Bank sand.
No. 29	Southeastern Maine	3.84	...	none	132	145	134	Bank sand.
No. 30	Western New York	2.86	4.9	20	124	138	136	Good. Bank sand.
No. 31	Southeastern New York	4.34	...	20	100	110	102	River sand.
No. 32	Western New York	2.72	1.1	100	87	101	103	Bank sand. Irregular.
No. 33	Eastern New York	2.64	2.2	20	81	86	81	Beach sand.
No. 34	Southern New Jersey	2.74	0.3	20	144	120	123	Bank sand.
No. 35	Southern New Jersey	2.52	0.8	100	95	108	102	Bank sand.
No. 36	Southern New Jersey	2.08	1.2	20	98	96	93	Excess fine. River sand.
No. 37	Southern New Jersey	3.04	0.2	none	144	138	116	Lacks fines. River sand.
No. 38	Southern New Jersey	2.45	0.4	250	121	107	102	River sand.
No. 39	Southern New Jersey	2.54	0.1	100	118	120	113	Bank sand.
No. 40	Southern New Jersey	2.60	0.2	100	100	117	114	River sand.
No. 41	Northeastern New Jersey	2.25	3.8	20	113	116	113	River sand.
No. 42	Central New Jersey	1.86	0.9	none	95	95	97	Beach sand.
No. 43	Northern Maryland	2.87	1.0	20	105	112	115	River sand.
No. 44	Central Tennessee	....	...	200	125	89	92	Excess fine. River sand.
No. 45	Central Tennessee	....	...	250	70	83	78	Excess fine. River sand.
No. 46	Central Tennessee	....	...	200	93	121	93	River sand.
No. 47	Central Tennessee	....	...	200	82	115	86	River sand.
No. 48	Tennessee	2.94	1.2	none	110	147	154	Bank sand.
No. 49	Tennessee	3.03	0.7	100	83	103	83	River sand.
No. 50	Tennessee	1.46	6.2	20	53	68	58	River sand.
No. 51	Tennessee	2.68	0.3	20	88	95	91	River sand.
No. 52	Tennessee	2.10	0.8	250	84	86	79	Excess fine. Bank sand.
No. 53	Tennessee	2.74	0.4	200	92	93	82	Irregular. Bank sand.
No. 54	Tennessee	2.88	0.2	20	100	100	98	River sand.
No. 55	Delaware	2.92	1.2	100	138	131	139	Bank sand.
No. 56	West Virginia	2.39	0.4	250	58	81	85	Irregular. River sand.
No. 57	West Virginia	2.37	0.5	250	115	100	106	Poor. River sand.
No. 58	West Virginia	2.60	0.5	250	100	95	99	River sand.
No. 59	South Carolina	2.98	passable	20	96	101	96	Bank sand.
No. 60	South Carolina	2.31	excess	20	74	82	72	Bank sand.
No. 61	South Carolina	2.27	excess	20	60	87	76	Passable. Bank sand.
No. 62	South Carolina	3.04	0.5	20	60	87	76	Bank sand.
No. 63	South Carolina	3.39	0.4	250	121	118	115	Bank sand.
No. 64	South Carolina	2.98	...	80	100	93	83	Bank sand.
No. 65	Louisiana	2.16	1.3	20	100	103	98	High fine. River sand

Table I (Continued)

No. 66	Eastern Georgia	2.64	0.2	137	37	139	136	River sand.
No. 67	Eastern Georgia	2.97	0.2	80	80	87	80	Poor. River sand.
No. 68	Georgia	2.10	1.0	100	85	91	83	River sand.
No. 69	Georgia	2.00	0.2	100	71	90	80	Bank sand.
No. 70	Azores	1.92	1.5	none	43	72	68	Volcanic origin. Beach sand.
No. 71	Azores	3.72	3.0	none	70	96	83	Volcanic origin. Beach sand.
No. 72	Azores	2.95	0.1	none	156	158	130	Volcanic. Lacks fines. Beach sand.
No. 73	Azores	3.27	...	none	94	101	90	Volcanic. Beach sand.
No. 74	Azores	2.82	...	none	67	107	90	Volcanic. Beach sand.
No. 75	Azores	3.12	...	none	74	110	88	Volcanic. Beach sand.
No. 76	Panama	2.80	3.4	100	97	115	100	Limestone. River sand.
No. 77	Panama	3.29	3.2	60	95	105	106	River sand.
No. 78	Central Ohio	3.52	1.4	20	145	156	157	River sand.
No. 79	Central Ohio	4.03	1.1	20	124	156	145	Coarse. River sand.
No. 80	Northern Michigan	3.14	0.7	20	134	146	125	Bank sand.
No. 81	Northwestern Illinois	3.57	0.3	none	160	146	140	Coarse. Bank sand.
No. 82	Central Illinois	2.75	0.5	100	100	100	103	Bank sand.
No. 83	Illinois	1.60	0.8	none	48	37	51	Very fine. Carbon coated. Special.
No. 84	Arkansas	2.01	0.6	250	89	75	90	Poor. River sand

Table II—Results of Tests on Fine Aggregates, Including Portland Cement Tests

Test	Source of Fine Aggregate	Fineness Modulus	Silt, per cent	Organic Matter, parts per million of tannic acid	Strength Ratio, Portland Cement			Remarks
					3 Days	7 Days	28 Days	
No. 1	Massachusetts	....	...	...	121	114	108	Bank sand.
No. 2	Northeastern Massachusetts	....	...	none	101	103	102	Bank sand.
No. 3	Northeastern Massachusetts	....	...	none	102	102	101	Bank sand.
No. 4	Northeastern Massachusetts	3.58	....	none	155	121	141	Bank sand.
No. 5	Northeastern Massachusetts	2.86	...	none	124	112	102	Bank sand.
No. 6	Northeastern Massachusetts	3.06	...	none	114	102	102	Bank sand.
No. 7	Central Massachusetts	....	...	100	100	104	87	Bank sand.
No. 8	Massachusetts	....	...	500	6	4	46	Band sand.
No. 9	Massachusetts	....	...	none	100	100	95	Bank sand.
No. 10	Eastern Massachusetts	....	...	none	100	109	86	Bank sand.
No. 11	Massachusetts	....	...	none	98	102	111	Bank sand.
No. 12	Northeastern Massachusetts	....	...	none	95	100	101	Bank sand.
No. 13	Northeastern Massachusetts	....	...	none	100	161	100	Bank sand.
No. 14	Northeastern Massachusetts	....	...	none	96	101	101	Bank sand.
No. 15	Northeastern Massachusetts	....	...	none	101	102	103	Bank sand.
No. 16	Massachusetts	....	...	none	101	116	125	Bank sand.
No. 17	Massachusetts	....	...	none	117	125	110	River sand.
No. 18	Massachusetts	....	...	none	96	101	101	Bank sand.
No. 19	Massachusetts	....	...	none	105	120	107	Bank sand.
No. 20	Massachusetts	2.06	...	none	57	71	80	Bank sand.
No. 21	Massachusetts	....	...	none	119	100	100	Bank sand.
No. 22	Massachusetts	....	...	none	123	109	101	Bank sand.
No. 23	Massachusetts	....	...	20	104	103	107	Bank sand.
No. 24	Massachusetts	....	...	none	101	116	125	Bank sand.
No. 25	Massachusetts	....	...	none	101	100	102	Bank sand.
No. 26	Massachusetts	3.85	...	none	102	107	103	Bank sand.
No. 27	Massachusetts	....	...	none	113	100	101	Bank sand.
No. 28	Massachusetts	....	...	none	102	105	105	Bank sand.
No. 29	Massachusetts	....	...	350	145	143	118	Bank sand.
No. 30	Massachusetts	2.39	3.1	300	96	86	82	Bank sand.
No. 31	Massachusetts	3.13	...	none	132	129	121	River sand.
No. 32	Massachusetts	3.43	0.5	20	123	138	118	Bank sand.
No. 33	Massachusetts	2.36	..	250	125	116	93	Bank sand.
No. 34	Massachusetts	3.57	...	350	146	146	127	Bank sand.
No. 35	Massachusetts	2.50	...	none	100	100	103	Bank sand.
No. 36	Massachusetts	3.10	...	none	113	115	106	Bank sand.
No. 37	Massachusetts	2.55	...	none	101	100	100	Bank sand.
No. 38	Massachusetts	2.66	...	none	92	94	100	Bank sand.
No. 39	Massachusetts	2.67	...	none	123	112	112	Irregular. Bank sand.
No. 40	Massachusetts	3.14	...	none	114	112	112	Irregular. Bank sand.
No. 41	Massachusetts	3.10	...	500	33	86	57	Coarse. Bank sand.
No. 42	Massachusetts	2.67	...	none	100	102	102	Bank sand.
No. 43	Massachusetts	2.55	...	none	99	100	108	Bank sand.
No. 44	Massachusetts	2.73	...	none	96	125	115	Bank sand.
No. 45	Massachusetts	3.10	excess	none	113	115	106	Bank sand.
No. 46	Massachusetts	2.55	2.0	none	100	113	102	Bank sand.
No. 47	Massachusetts	3.42	5.4	none	129	141	111	Bank sand.
No. 48	Massachusetts	2.44	0.76	none	106	121	121	Bank sand.
No. 49	Massachusetts	3.10	0.61	none	121	142	148	Bank sand.
No. 50	Massachusetts	2.76	...	100	104	131	112	Bank sand.
No. 51	Massachusetts	2.12	...	100	74	81	80	Excess fines. Bank sand.
No. 52	Massachusetts	2.21	2	20	126	122	93	Bank sand.
No. 53	Western Massachusetts	....	...	none	150	136	118	Bank sand.
No. 54	Massachusetts	....	...	none	123	124	140	Bank sand.
No. 55	Western Massachusetts	....	...	none	74	80	85	Bank sand.
No. 56	Massachusetts	....	...	none	92	95	101	Bank sand
No. 57	Massachusetts	2.75	...	none	112	119	115	Bank sand.
No. 58	Massachusetts	....	...	none	114	20	109	Bank sand.
No. 59	Massachusetts	2.35	...	none	128	128	120	Bank sand.
No. 60	Massachusetts	....	...	350	71	92	90	Bank sand.
No. 61	Massachusetts	....	...	none	136	146	125	Bank sand.
No. 62	Massachusetts	....	...	none	131	127	113	Bank sand.
No. 63	Massachusetts	3.01	...	none	131	107	105	Bank sand.
No. 64	Massachusetts	....	...	none	114	120	103	Bank sand.
No. 65	Massachusetts	2.26	...	none	134	125	104	Bank sand.
No. 66	Maine	3.33	...	none	103	105	104	Bank sand.
No. 67	Maine	2.24	...	none	103	105	104	Bank sand.
No. 68	Maine	....	...	100	82	93	92	Bank sand
No. 69	Maine	....	...	350	72	72	79	Bank sand
No. 70	Southeastern Maine	....	...	none	78	100	100	Bank sand

adopted as standard laboratory practice to supplement the portland-cement tests at 7 and 28 days.

Test Procedure.—The procedure used for this test is in accordance with the requirements of the A. S. T. M. Specifications for Concrete Aggregates (C 33—26 T), except that certain details which are not definitely stated in the specifications have been standardized for our work. A batch using 750 g. of standard sand, 250 g. of cement and a quantity of water based on the normal consistency of the cement, is made up and the consistency of this batch determined by a small flow table. The proper amount of water that will give the same consistency for the job sand as that of the standard sand is then determined by trial. The briquets are made using the quantity of water so determined. The water used for the Lumnite briquets is in the same proportion, but is based on the normal consistency of the Lumnite cement.

This consistency, as mentioned above, is determined by means of a small flow table. This table is similar in construction to the usual flow table used for concrete, except that the plate is only 10 in. in diameter and has a drop of ¼ in. The truncated cone used with it is 2 in. deep and tapers from a diameter of 2¾ in. at the top to 4 in. at the bottom. The procedure in using this apparatus is to fill the mold to one-third of its height with the mortar, then rod 25 times with a ¼-in. diameter rod; repeat for two-thirds full; and finally fill and rod. The top is levelled off by four strokes of the trowel and the cone removed at once. The table is then jigged for 45 seconds at the rate of one drop every 1½ seconds. The average diameter of the base of the cone of mortar is measured with a caliper and this is fixed and used for the job sand.

The portland-cement briquets are stored in the standard manner. The Lumnite-cement specimens are covered with steel or glass plates on both sides and it is important that these be held tightly in place.

The essential requirements for success in the use of this method is the absolute prevention of contamination of the Lumnite cement by portland cement, lime and calcium chloride, and use of the plates on both sides of the specimens. It is preferable that entirely separate tables be used for the two cements. Failure to observe these precautions will result in faulty briquets.

Test Data.—Table I gives data from commercial tests made on fine aggregate for concrete using the Lumnite-cement 24-hour test to supplement the usual 7 and 28-day portland-cement tests. The data are not selected data, but represent all that it is feasible to present at this time. The tests were made by several different operators using seven different brands of portland cement. Certain characteristics of the materials are indicated where available. The strength ratio for the Lumnite cement is based on Lumnite-cement briquets as 100 made at the same time using standard Ottawa sand. The strength ratio for the portland cement is based on portland-cement briquets as

Table II (Continued)

No. 71	Southeastern Maine	....	...	none	95	89	91	Bank sand.
No. 72	Southeastern Maine	....	...	none	92	77	82	Bank sand.
No. 73	Southeastern Maine	....	...	none	120	141	136	Bank sand.
No. 74	Maine	2.45	...	none	82	106	109	Bank sand.
No. 75	Maine	2.52	...	none	83	109	109	Irregular. Bank sand.
No. 76	Maine	2.61	...	20	53	93	91	Irregular. Bank sand.
No. 77	Maine	2.38	...	none	101	126	129	Bank sand.
No. 78	South Carolina	2.03	...	none	102	102	101	Bank sand.
No. 79	Vermont	....	...	100	110	102	101	Bank sand.
No. 80	Vermont	....	...	500	46	31	23	Bank sand.
No. 81	Connecticut	....	...	5	30	56	67	Bank sand.
No. 82	Connecticut	....	...	100	89	96	98	Bank sand.
No. 83	Connecticut	....	...	100	85	96	100	Bank sand.
No. 84	Connecticut	....	...	none	110	119	123	Bank sand.
No. 85	Connecticut	2.31	...	none	100	111	103	Excess fines. Bank sand.
No. 86	New Hampshire	....	...	none	111	104	102	Bank sand.
No. 87	New Hampshire	....	...	350	78	94	85	Bank sand.
No. 88	New Hampshire	2.02	...	none	131	107	105	Bank sand.
No. 89	New Hampshire	1.77	...	none	112	119	115	Bank sand.
No. 90	New York	....	...	none	102	102	101	Bank sand.
No. 91	Eastern Pennsylvania	....	...	none	131	131	152	Slag.
No. 92	Central Pennsylvania	2.81	...	none	108	115	118	Bank sand.
No. 93	Central Pennsylvania	1.66	...	350	62	63	75	Bank sand.
No. 94	Pennsylvania	....	...	none	106	102	103	Bank sand.
No. 95	Pennsylvania	....	...	none	71	65	98	Bank sand.
No. 96	Eastern Pennsylvania	....	...	none	84	84	95	Slag.
No. 97	New Jersey	....	...	none	106	112	110	Bank sand.
No. 98	Maryland	....	...	none	132	129	113	Bank sand.
No. 99	District of Columbia	....	...	none	116	101	99	River sand.
No. 100	District of Columbia	....	...	none	75	68	88	River sand.
No. 101	Tennessee	....	...	20	96	93	98	Bank sand.
No. 102	Tennessee	....	...	20	100	102	105	Bank sand.
No. 103	Tennessee	2.58	...	none	88	91	92	Bank sand.
No. 104	Tennessee	2.93	...	20	87	98	89	Irregular. Bank sand.
No. 105	Tennessee	2.83	...	250	102	102	101	Irregular. Bank sand.
No. 106	Kentucky	3.40	...	none	161	151	148	Bank sand.
No. 107	Kentucky	3.18	...	100	59	73	85	Bank sand.
No. 108	North Carolina	2.99	0.2	20	100	103	107	Bank sand.
No. 109	Florida	....	...	none	100	100	101	Excess fines. River sand.
No. 110	New York	....	...	none	95	101	136	Bank sand.
No. 111	Minnesota	3.27	...	none	145	139	121	Soft stone. Bank sand.
No. 112	Minnesota	....	...	none	104	131	100	Bank sand.

100 made at the same time as the Lumnite briquets and using standard sand. Under the heading "Remarks" is included information as to the brand of sand and its grading. Sand concerning which there are no remarks may in general be considered as being of fairly satisfactory grading.

Table II is given for comparison of the 3-day mortar test with the Lumnite-cement tests given in Table I. It presents data from commercial tests of fine aggregate for concrete made during a period of three to four years prior to the Lumnite tests. There was much less information available in regard to the characteristics of those materials than for those tested during the last two years. The strength ratio for the 3-day portland-cement briquets is based on a corresponding set using standard sand as 100 and made at the same time.

Discussion.—The data in Table I show considerable variation in individual cases between the Lumnite-cement test and the portland-cement 28-day test, which is taken as standard. The average difference, however, is negligible, the Lumnite test tending to be slightly optimistic. The 7-day tests with the portland cement do not agree as closely with the 28-day tests as do the Lumnite tests.

We use a mortar-strength ratio of 85 per cent at 28 days as the lowest acceptable for a concrete aggregate which shows a high organic content. Using this as a basis, it would appear from the table that only four would have been rejected which were usable and two would have been accepted which were not usable. Actually, other factors governed in all of these cases.

Comparing the information of Table II with that of Table I, it is seen that the two methods of test show about the same average variation from the 28-day ratio, but the 3-day test is slightly pessimistic, while the Lumnite test is slightly optimistic.

Conclusion.—The Lumnite-cement 24-hour mortar test for determining the quality of fine aggregate for concrete, made in accordance with the method described in this paper, gives results comparable with those obtained by the portland-cement mortar test at 28 days. We consider it of value where information must be obtained concerning the qualities of fine aggregate within 24 hours and which is to be checked by portland-cement tests later.

The Need for Traffic Engineers for Cities

A city engineer charged with the constant study of local traffic conditions in order to observe changing needs and counsel adequate preparations to meet them should be in the service of every American city of more than 25,000 population and in many smaller cities as well, according to a recent statement by Miller McClintock, director of the Albert Russel Erskine Bureau for Street Traffic Research.

The complexities of modern city traffic brought about by the rapid increase of motor vehicle registrations, changes in city conditions as a result of building operations, the shift of business districts and many other factors require constant study if a city is to keep abreast of its traffic and safety problems, he stated in Chicago before more than 100 mayors and city officials who had met to discuss traffic and safety matters.

"Few problems of administration facing officials of American cities have become as important and complex in the past decade as the effective regulation of street traffic. Provided for the most part with an archaic code of traffic laws as out of date as the horse and buggy, they have been put to the necessity of coping as best they could with the task of traffic control. From time to time the pressure of conditions brought about changes in administrative organization and traffic control, but these changes have seldom been developed on a basis of thorough engineering study of all the problems involved."

One of the major recommendations in the widely quoted Chicago traffic survey made by the Erskine Bureau, which is endowed in Harvard University by the Studebaker Corporation, involved the creation of a traffic engineering division in the department of public works and the appointment of an engineer whose full duty should be the study of street accidents and traffic conditions, the preparation of recommendations for improvement, and supervision of the placing and operation of all city traffic signs and signals.

Adoption of this recommendation by a special act of the city council set a precedent many other large cities are considering in the treatment of their traffic difficulties.

The city traffic engineer serves to supply accurate and up-to-date information to the city traffic commission, also formed on the basis of the traffic survey's report and recommendation, and consisting of representatives of city departments charged with the various duties relating to traffic control.

This recommendation for a city traffic engineer and traffic commission is in harmony with the proposals of the National Conference on Street and Highway Safety formed by Herbert Hoover, Secretary of Commerce. "The traffic commission should have accurate records of traffic movement, observe changing conditions affecting trade, suggest amendments to the traffic ordinance and keep the traffic survey and plan up-to-date," says the Hoover committee's report.

The Chicago survey's recommendation for a traffic engineer and city traffic committee was based on the assumption that satisfactory control of traffic can never come from casual observation or guess-work, but must be based on sound facts gathered along engineering lines. One of the functions of the Erskine Bureau, as outlined by A. R. Erskine, president of the Studebaker Corporation, is to aid American cities in the development of better traffic regulation and safety measures through engineering research in street traffic problems. In carrying out this work Dr. McClintock, as director of the bureau, is serving as traffic consultant and director of traffic surveys in Chicago, Los Angeles, Boston, San Francisco, and a number of other cities faced with acute traffic problems.

Traffic Control

Recommendations to Improve Street Conditions Given in Paper Before National Highway Traffic Association Summarized in American Municipalities

By PROF. L. W. McINTYRE

Traffic regulation seems to be responsible for much heated comment in Toledo at the present time. Suggestions, recommendations, warnings and threats have been broadcasted right and left by newspapers, organizations and individuals.

For the purpose of additional comment, we present here a summary of traffic regulations, particularly in reference to pedestrian traffic, made by Prof. L. W. McIntyre, in a paper read before the convention of the National Highway Traffic Association:

"1. Regulations adopted should be as few as possible.

"2. No regulation should be placed on the statute books which cannot or will not be completely and continually enforced.

"3. Adequate traffic regulation is expensive. The community will balance the entire cost of sanely planning and sympathetically enforcing a given regulation against the benefits to be derived. If they are unwilling to pay the entire cost, a given regulation had better not be adopted.

"4. The majority of contemporary opinion seems to favor some form of pedestrian regulation.

"5. The regulation of pedestrians is not at present justified from either the standpoint of expediting pedestrian travel, or of expediting vehicular travel.

"6. Since the pedestrian is involved in two-thirds of the traffic accidents involving injury and death, and pedestrian accidents are increasing disproportionately to other types of traffic accidents; since 35 per cent of all traffic casualties are directly caused by some act of the pedestrian, it is imperative that some action be taken to reduce this pedestrian hazard.

"7. Forty per cent of the traffic accidents for which the pedestrian is to blame are caused by children playing in the street; and two-thirds of all the child traffic fatalities occur between intersections. These are hazards against which any practical regulation would be almost entirely ineffective. Therefore, there should be carried on in the public schools everywhere, a continuous campaign of safety education.

"8. Fifty per cent of the traffic accidents for which the pedestrian is to blame are caused by jaywalking or carelessness on his part. Here again a continuous, intelligent, educational campaign seems likely to be the cheapest, most effective and least irritating measure to adopt, at least at present.

"9. It seems wise to recommend that traffic authorities be empowered to select certain intersections which the accident record shows to be particularly hazardous to pedestrians and where the cause of such accidents indicate that regulatory measures will be effective. Here they might be empowered by means of a blanket ordinance to put into effect such simple measures as obedience to the traffic signal, crossing only on the crosswalks.

"10. An engineer does not design a bridge without basic engineering data upon which to work. Neither can effective traffic regulation nor accident reduction measures be planned without adequate underlying data concerning causes of accidents. It is the first duty of those in charge of traffic control to secure such data. In its absence a community will only get changing, irritable and ineffective measures.

"11. Adequate enforcement of traffic regulations is not secured by short period drives for the enforcement of one particular regulation to the complete neglect of others. Those regulations which are in the discard for long periods of time become almost completely ineffective, and the result of such procedure is to build up in the mind of the public a willingness to disobey all law if they 'can get away with it.'

"12. Educational measures should be given more prominence and more money should be spent on them. They should be continuous instead of spasmodic. They should aim to tell the public the 'why' of traffic regulatory measures. If a measure is designed to prevent accidents at a certain point, the educational campaign should show the public the accident figures on which the need for the measure is based. Such educational efforts must be unceasing."

Relation of Type of Pavement to Street Cleaning

Abstract of Paper Read Before International Association of Street Sanitary Officials, as Reported in Public Works.

By JOHN KLORER

Commissioner of Public Property, New Orleans, La.

There can be no question that the type of pavement has a definite relation to street cleaning in the matter of expense involved. Other conditions being the same, it is apparent that the smoother the type of pavement the less costly should be the cleaning. It is also true, however, that costs of cleaning the same type of pavement will vary with degrees of the roughness of the pavement.

There are, however, other factors besides the type of pavement which contribute their share to the cost of street cleaning, and a fair, comprehensive study of street cleaning costs with reference to type of pavement cannot exclude the consideration of these factors. Some of these are: 1. The time at which cleaning is done, whether by day or by night. 2. The quantity and quality of street refuse. 3. The method of cleaning necessary to follow, as influenced by parking or other conditions. 4. The standard of cleanliness required or the frequency of cleaning.

In some smooth pavements in quiet suburban districts, the cleaning of litter from falling leaves may be more expensive than the cleaning of some commercial streets with pavements not so smooth and carrying three or four times the traffic. In the residential section of New Orleans perhaps the most potent factor contributing to street cleaning costs is the extent of pavement that is present or lacking on the intersecting streets. One of the main streets of new Orleans is cleaned for a distance of 8,100 feet of double roadway, four times a week by two patrolmen using hand brooms, and a clean appearance is maintained because nearly every intersecting street is paved. A little further out, where unpaved streets intersect it each of which yields a supply of clay to wheels of passing vehicles, seven men are required to keep the same length of the same kind of pavement in the same condition as that accomplished by the two men referred to.

Granite block is the customary type of pavement on the heavy commercial, wholesale or industrial district, and the cost of cleaning here is frequently very heavy. This, however, may be due largely to the quantity of refuse on these streets and the fact that they are apt to be uneven because of the heavy tonnage which travels over them and the fact that repairs have to be made in a hurried and expeditious way.

On old granite pavements, both because of the former method of construction and because in the early years steel tired and horse drawn carriages tended to cobble the blocks, cleaning is difficult and expensive. Where a high standard of cleanliness is required on such a street it is advisable to place an asphaltic type of wearing surface. The expense involved in this surfacing may often be justified by the saving accomplished within a few years in the cost of cleaning alone.

Concrete pavements have certain features that commend them from a street cleaning point of view. They are fairly smooth when constructed and become more so under traffic. When subgrade conditions are satisfactory they maintain a surface intact. The color of concrete does not accentuate the presence of fine dust or dirt and therefore is can remain unwashed for a longer period than asphalt without presenting an objectionable appearance. Asphalt surfaces, being smooth are easy to clean, but their dark color and absence

of joints tend to attract attention to what on other types of pavement would be a negligible quantity of dirt and dust.

Concluding Mr. Klorer said, "I particularly wish to emphasize the point that the type of pavement is not so important a factor in the cost of street cleaning as other factors to which reference was made."

Discussing the same subject, E. A. Kingsley, city engineer of Dallas, Texas, stated that night parking added considerably to the difficulty of thoroughly cleaning the streets. In the business district the streets are occupied by parked automobiles practically all of the 24 hours except between midnight and six o'clock in the morning. In the residential district, day time or early evening seems to be the preferred time for cleaning, one reason being that the noise made by cleaners during the later hours of the night is objectionable. Consequently Dallas has selected the day time for cleaning the residential district and night time for the downtown district. The early hours of the night are spent in cleaning streets in the wholesale or warehouse district and the adjacent streets and the time after midnight, when the theater crowds have dispersed, is taken for cleaning the main business streets where the parking has been heaviest.

Mr. Kinsley found sweepers, not as satisfactory as flushing on brick streets because of the small amount of dust left in the joints of the brick pavements. He did not, however, find any material difference in cost between sweeping brick, concrete or asphalt. In sweeping the streets, they combine a pick-up and a non-pickup sweeper. The non-pickup sweeper is run in the center of the street, forcing the litter towards the side, where it is picked up by the pick-up sweeper. The pickup sweeper broom overlaps the edge of the path of the non-pickup sweeper and takes care of the rubbish from half the street. As the middle and quarter sections of the streets are usually not very dirty, the total amount of dirt worked over by the non-pickup does not furnish any more material for the left half of the trash box of the pickup sweeper than it obtains normally from the gutter of the roadway. Consequently this method does not materially decrease the periods between dumpings of the trash boxes.

The Iowa Consolidated Tax

Its Workings Described in American Municipalities

Cities and towns will find that their finances will be in much better shape if they take advantage of a consolidated tax levy. In few cities and towns will the general fund levy, bring in enough to pay the necessary expenses and make the improvements that the council desire. By use of the consolidated tax several special taxes can be consolidated with the general fund and then this consolidated levy can be appropriated to any of the included funds the council desires.

The principle of this law (Iowa) is that it is proper to allow a city or town to consolidate the funds that can be used for current expenses and current repairs, but that bond funds or any fund pledged to pay obligations incurred for permanent improvements should not be diverted from the use to which they are pledged.

The great advantage of working under the consolidated tax is in the fact that the money received from several levies can be used for any purpose that any of the combined funds can be used. If the entire levy in a certain fund is not needed for that particular purpose it can be used for some other purpose.

The law is as follows:

Section six thousand two hundred seventeen (6217) of the code, 1924. In lieu of any or all of the separate annual levies for the general fund, the grading fund, the improvement fund, the city or town sewer fund, the water fund, the gas or electric light or power fund, cities and towns may levy one tax which shall not in the aggregate exceed the total amount of taxes which such municipality might have levied therefor. The city or town making such consolidated levy shall, prior to the first day of April thereafter, appropriate the estimated revenue from such consolidated levy, in such ratio as the council may determine, for any purpose for which such funds might have been used, but no part thereof shall be used for any other purpose.

Section six thousand two hundred eighteen (6218) of the code, 1924. Whenever the power granted in the preceding section is exercised by any city or town, it shall be the duty of the council prior to the first day of April each year to make up and prepare an annual budget on the basis of estimates of the expenses of the several departments of such city or town. Such estimates shall show not only the purpose for which the consolidated levy authorized in the preceding section is to be used, but in addition thereto the purpose for which all other levies authorized to be made by said city or town are to be used, so that said budget, when so made up, will show all of the proposed expenditures for the ensuing year. Such budget of proposed expenditures shall be published in one or more newspapers of general circulation published in such city or town, but where no newspaper is published in such town, then by posting in three public places, the publication to be at least two weeks before said budget is finally adopted by the council, and the time when such budget will be considered by the council for adoption shall be stated in said publication. On the day thus fixed for considering said budget, full opportunity shall be given for hearing any objections or protests which any taxpayer of the city or town may desire to make to any item or items in such budget or to any omissions therefrom.

Section six thousand two hundred nineteen (6219) of the code, 1924. Nothing in the two preceding sections shall be construed to affect or repeal any of the existing statutes authorizing tax levies in cities and towns.

The following funds are the ones that can be consolidated under the law as given above.

Section six thousand two hundred seven (6207) of the code, 1924. The council of each city or town shall levy a tax for the year then ensuing, for the purpose of defraying its general and incidental expenses, which shall not exceed ten mills on the dollar.

Paragraph one (1) section six thousand two hundred eleven (6211) of the code, 1924. Any city or town shall have power to levy annually the following special taxes:

1. Grading fund. Not exceeding three mills, which shall be used only for the purpose of opening, widening, extending and grading any street, highway, avenue, alley, public ground, or market place.

2. Water fund. Not exceeding five mills, which shall be used only to pay the amount due or to become due for water supplied under any contract. In cities of the first class, if the maximum tax is insufficient to pay such amount, the deficiency shall be paid out of the general fund.

3. Improvement fund. Not exceeding five mills, which shall be used only to pay for deficiencies in assessments and for plats and schedules as provided by law, and for the construction, reconstruction, and repair of any street improvement at the intersections of streets, highways, avenues and alleys, and for one-half of the cost of such improvement at the intersections of streets, highways, avenues and alleys not crossing, and for spaces opposite property owned by the city or town and by the United States, and for the purchase price of property purchased by the city at tax sale and subsequent taxes assessed against such property.

5. Sewer fund. If the city or town comprises one sewer district, not exceeding five mills, which shall be used only to pay for deficiencies in assessments as provided by law, and for the construction, reconstruction and repair of any sewer at the intersection of streets, highways, avenues and alleys not crossing, and for spaces opposite property owned by the city or town and by the United States, and for the whole or any part of the construction, reconstruction or repair of any sewer within the limits of said city or town, and for the maintenance and operation of any sewage disposal plant serving said sewer district.

10. Gas light, electric light, heat, or power funds. Any city with a popula-

tion of more than five thousand, not exceeding five mills, and any city with a population of less than five thousand and any town, not exceeding seven mills, which shall be used only to pay the amount due or to become due under any contract for gas light, electric light, heat, or power, including expenses of inspection.

In case the grading fund, the improvement fund, or the sewer fund have been anticipated in accordance with the provisions of section six thousand two hundred sixty-one (6261) of the code, 1924, the certificates or bonds must be taken care of in the appropriations ordinance and provisions made to pay any bonds or certificates to be paid out of these funds.

The right to levy a tax for water as provided above is of little value because few of the cities and towns purchase water from a private water company and where the town has its own water system this tax cannot be levied. Where the waterworks is under the control of a board of waterworks trustees and the city levies a tax to pay for hydrant rentals then this tax can be included in the consolidated tax.

Where a city or town owns its own lighting system, unless the system is under the control of a board of trustees, the tax for electric services cannot be levied, but in all towns buying current for street lighting this tax can be levied.

Where a city or town owns its waterworks, but the waterworks is not under the control of trustees but under the control of the council, the following taxes can be combined in the consolidated tax.

General fund 10 mills.
Grading fund 3 mills.
Improvement fund 5 mills.
Sewer fund 5 mills.
Light fund 7 mills.

When it is desired to take advantage of the consolidated tax levy the resolution of the council making the levy should levy a consolidated tax of the number of mills or amount in money they desire and then also levy any other special taxes that are not included in the consolidated levy, that they desire. The form of a resolution levying this tax would be about as follows:

"Be it resolved by the Council of the town of ....., Iowa.

"There is hereby levied taxes for municipal purposes, for the ensuing year, the following number of mills on the dollar.

"..... Mills on the dollar for the consolidated fund as provided by section six thousand two hundred seventeen (6217) of the code, 1924.

"..... Mills on the dollar for a bond fund to pay electric light funds.

"(Note: Run any of the special taxes you desire to levy other than those combined in the consolidated levy.)

"Five mills on the dollar on all lands of more than ten acres which shall also, in good faith, be occupied and used for agricultural or horticultural purposes and all personal property necessary for the use of agricultural and horticultural land, for road purposes.

"Be it further resolved that all property within the corporate limits, other than lands of more than ten (10) acres in extent used for agricultural and horticultural purposes, are within the limits of the benefits, and protection of said tax levy.

"Be it further resolved that the clerk is hereby ordered to certify the sums of money the above tax levy will amount to in money to the county auditor as provided by law."

This consolidated tax should be embodied in your proceedings under the budget law and then the consolidated tax should be included in your tax levy as made under the budget.

According to section five thousand two hundred eighteen (5218) of the code, 1924, appropriations must be made for the funds before the first of April of each year. There is a slight conflict between this section of the law and the budget law in regard to appropriations. The chances are that this conflict will be straightened out by the present legislature.

The ideas of a budget is to take the total amount of money that you expect to receive in the consolidated fund and divide it up for the different purposes, setting aside a certain amount for each purpose. A budget for a town might well have a heading "officers salaries," with a sub-head of the salary for each office, cost of street lights, office expense, road work and any other item that the council desire to set aside money for at the beginning of the year. The more in detail the budget goes, the better understanding the officers and people have of the financial affairs of the town.

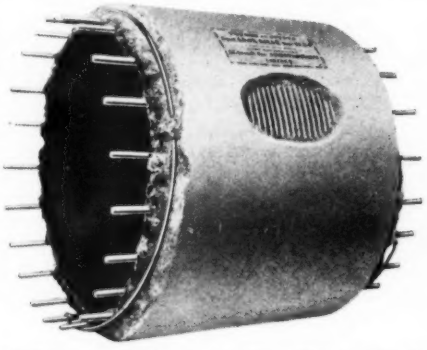
Outside of the consolidated fund, the income from the other funds levied should be set aside for the specific purpose for which they are levied, as the law provides that this budget shall cover all of the funds as well as the consolidated fund.

According to paragraph sixteen (16), section five thousand six hundred sixty-three (5663) of the code, 1924, all cities must make the appropriation for all the different expenditures at or before the beginning thereof. The appropriations are made by an appropriation ordinance. There is no provision in the law requiring towns to make appropriations, but the adopting of a budget has very largely the same effect as making appropriations. Every council that adopts the consolidated tax should be very sure to also adopt a budget.

A Reinforced Concrete Pipe with Asphalt Lining

Reinforced concrete pipe manufactured according to the Moir-Buchanan process and lined with asphalt by the Bille-Ligonnet process, both processes perfected in France and already used in several other countries, has been introduced to American water works officials by the Asphalto-Concrete Corporation, 1440 Broadway, New York City. Both processes involve the use of equipment that utilizes centrifugal force and is said to produce a very good product.

By means of the Bille-Ligonnet process the green pipe already formed are given an inner coating of large aggregates and water that are partly embedded in the concrete by means of centrifugal force. The stones are then heated, and a quantity of bitumens are introduced into the mold, further spinning causes this to adhere in a thick uniform layer to the projecting stones that are already embedded partially in



Section of Bille-Ligonnet Pipe Showing Steel Reinforcement and the Asphalt Lining.

the concrete, and which tie the asphalt to the concrete effectively. A second finish coating is then spun in, and the pipe is ready for service. A pressure joint system has also been devised. This system of asphalting concrete has also been applied to building block and tile and to paving block.

By means of the Moir-Buchanan process, according to which the pipe are made, a combination centrifugal and trowelling action is given in the machine, and the result is a concrete pipe, reinforced as desired, that is built up in concentric layers, each containing the aggregates well distributed, of a concrete that is dense and strong, and with an inner surface that is trowelled smooth. "Y"s and "T"s may be cast at a slower rate on the same machine by means of special molds. Thus the usual process of cutting green pipe, and plastering in the connection, is eliminated.

The literature submitted by the concern cites a number of interesting tests that show the strength of the pipe so made, and its ability to hold water in face of high stresses when lined by the Bille-Ligonnet process.

Who Pays for Sewer Taps?

Survey in New York State Shows That the Property Owner Must Take Care of Sewer Connections in Most Municipalities

Municipal work of all kinds in the State of New York is greatly simplified by means of a coordinating bureau that furnishes information for the guidance of the municipalities of the state. This bureau, the New York State Bureau of Municipal Information, City Hall, Albany, N. Y., headed by W. P. Capes, director, and officered by mayors of various cities and towns in the state, makes a business of assembling and tabulating information on methods ruling municipal work in cities, towns, and villages, and places such information at the disposal of the communities of the state in order that they may be kept up to date on the best methods that may be developed.

Who Pays?—An interesting survey recently completed by the bureau tabulates matters relating to Sewer Taps. The first point displayed by the report is that out of 74 communities listed, 65 require the property owner to pay for sewer taps, 8 stand the cost out of municipal funds, and one, Binghamton, assesses property at $1.00 a foot (50 cents for corner lots) on new sewer work, this assessment giving the owner a connection to the curb line. In this city, if the owner wants a new connection the city carries it to the curb line by city forces and charges for actual labor and material. Another city, included in the 59, not only compells the property owner to defray the cost of the tap, but also charges him the cost of making the cut in the street and of repairing the pavement. The communities making no charge are Corning, Geneva, Hempstead, Johnstown, Lancaster, Middletown, and Watervliet. These latter towns all have a population of under 20,000.

Who Does the Work?—The second question in the survey shows by whom the actual work of connection is done. In fifteen of the communities listed the work of making the connection is done by city forces or by the city under contract. The following tabulation answers the question, "Does the Municipality Do This Work?"

Auburn—In new sewers municipality constructs laterals from main line sewer to city curb. Property owners construct lateral from curb to house. Existing street sewers property owners pay entire cost for house connection and arrange for work to be done. Where new sanitary street sewers are constructed and house connections built to curb line, abutting property owner pays entire cost. The work is done by municipality under contract. Where excavations are made by property owner, city requires the property owner to pay the cost and usually arranges for the work to be done.

Albany—No. The office of the Commissioner of Public Works issues permits free of charge to tap in the sewers. The property owner supervises this work and it is done by plumbing contract.

Albion—No.

Beacon—Plumbers' work.

Batavia—No.

Buffalo—No.

Corning—No.

Cohoes—No.

Cortland—No.

Catskill—Yes.

Dunkirk—No.

East Rochester—Yes.

Elmira—No. City bears the entire cost of trunk line and lateral sewers. It provides "Y" branches for the different property owners, locates such branches when owners wish to connect, makes inspections of such locations but pays for none of the service work.

Fredonia—No. Done by licensed plumbers.

Fulton—No, done by licensed plumbers. If sewer is put in after street is paved, property owner is required to pay, in addition to sewer connection, for repaving the street.

Glens Falls—Yes, from main to curb.

Gloversville—No, done by licensed plumbers.

Geneva—Yes, tap and lay first pipe.

Hempstead—Yes.

Hornell—No.

Hudson—No, done by property owners.

Hudson Falls—No.

Ithaca—No, done by licensed and bonded sewer layer. Inspected by city.

Johnstown—Yes.

Jamestown—Yes.

Kenmore—No. Owner has to pay for opening streets.

Kingston—No.

Little Falls—No.

Long Beach—Yes.

Lackawanna—No.

Lynbrook—No.

Lancaster—No, but city inspects.

Medina—No, but all connections are made under supervision of street superintendent. Whenever permanent pavement is constructed on streets all property owners are notified to make necesary sewer connections.

Mount Vernon—When sewers are laid spurs or "Y" connections are placed at points approximately 25 feet apart, allowing one for each 25 feet on each side of sewer. Cost of this work is assessed against abutting property owners. When the owner is ready to make the connections with the sewer his plumber applies for the permit. This permit costs $5.00 plus the flat rate for opening the pavement. The price of the pavement depends on the type in use.

Mamaroneck — Property owner under supervision of engineers.

Middletown—No.

Malone—No.

Newark—Yes.

Norwich—No. The licensed plumber makes the connection. The city reserves the right to restore all street openings and charge the cost thereof the person to whom the permit is issued.

Newburgh—The municipality does not make flat work connections. The property owner has this work done by his plumber who files a bond with the city to indemnify the city against any loss by reason of the opening of the street in the making of this sewer connection. The only charge by the municipality is where the street has a macadam or paved service. The city does this work and renders a statement of the cost to the property owner which he must pay.

Niagara Falls—No.

New Rochelle—Plumber.

New York City—Owner lays house connection into spur. City only inspects the work.

North Tonawanda—No, done by licensed plumber.

Oneida—No, done by licensed plumber. City lays sewer from main to curb besides tapping main sewer.

Oswego—Yes.

Plattsburgh—Owner does the work and city makes the connections on main sewers.

Penn Yan—City makes tap and supervises other work.

Port Chester—Only when owner fails to do it.

Peekskill—No.

Poughkeepsie—No.

Port Jervis—No, supervises only.

Rome—No, supervises only.

Rochester—No. When sewers are laid laterals are run to lot line to which property owner connects.

Rye—Yes.

Saranac Lake—Village makes the tap and consumer furnishes the material and opens and fills trench. Village lays service pipe from main to curb.

Salamanca—No, city supervises.

Schenectady—Yes, under contract between main and curb. Between curb and house it is installed by plumber engaged by owner.

Sherrill—No.

Syracuse—No.

Scotio—No.

Saratoga—No.

Scarsdale—No.

Seneca Falls—No.

Tonawanda—No.

Tarrytown—No.

Utica—When not done in advance of paving work, city does the work. On paved streets, property owner also pays for restoration of pavement.

Watertown—Yes.

Watervliet—No.

Yonkers.—No.

What Chargs Are Made?—Another question, relating to the amount charged property owners for the work of making sewer taps and connections, revealed a lack of uniformity in the rates charged and in the method of computing charges. The answers to this question follow:

Binghamton—In replacement of road surfaces city charges owners for labor and material if they desire a connection in a location other than where the original was located.

Beacon—$1.50.

Buffalo—The paving contractor is responsible for the construction of necessary lateral sewer and water connections. These connections are constructed under the supervision and in accordance with directions from the City Engineer, the unit rates for same being a part of the contract, but being a special assessment against the property benefited.

Catskill—Labor and materials.

Corning—Property owner pays for relaying of pavement. Plumbers are licensed and bonded and compelled to take out permits to open the streets.

Cortland—None.

Cohoes—$4.40 per square yard for restoring pavement.

East Rochester—Labor and material at cost.

Glens Falls—Dirt streets $17.00; Macadam $20.00; Paved $42.00.

Jamestown—Actual cost for work and materials up to $25.00.

Kenmore—In dirt or cinder streets 60 cts.; asphalt or brick $20.00; cement $15.00; Macadam $5.00; inside of curb, 60 cts.

Long Beach—An average of $15.00 is charged before the pavement is laid. If payment is laid and permit issued to dig up street, the average is $45.00.

Malone—This village has a peculiar situation in that the sewers are not under the supervision of the village, but are owned and maintained by sewer companies or associations, as they were before the village was incorporated, and only give permits allowing work in the streets to be done on them without the actual supervision.

Mamaroneck — Earth or macadam street $4.00 fee and $25.00 deposit. Paved streets $4.00 fee and $100.00 deposit.

Newark—Cost plus ten percent.

New Rochelle—Dirt streets, $7.50; macadamized streets $15.00; Penetration macadam streets, $30.00; asphalt and other paved streets, $40.00.

New York City—A charge of $10.00 is made for privilege of connecting to sewer in the Borough of Manhattan. The charge is made for the cost of issuing permit and for cost of restoring pavement if street has been paved. $1.00 is charged for permit and a deposit of $10.00 for 12 square yards, one-half for first restoration and other half for possible second restoration if settlement occurs, actual cost of labor and materials being charged and refund of balance, if any, being made. No charge for opening unpaved streets except for permit.

Ogdensburg—$5.00 is charged. Property owner stands the expense of excavation and back-filling. On paved streets sewers are laid as far as curb before paving.

Oswego—Cost of tile and labor.

Plattsburgh — For earth streets, $5.00; for macadam, $10.00; for paved streets, $25.00.

Penn Yan—$1.00 for tap. Property owner pays all other expenses.

Port Chester—Actual cost.

Rochester—Charge for actual time of inspector on job. If pavement is cut, property owner pays for repairs which are made by city.

Rye—About $1.75 where there is no rock.

Scarsdale—$25.00 for street opening deposit. Repairs made by village and deduction of cost of restoring highway made from deposit.

Sherrill—Property owner pays for sewer when it is laid. He makes tap at his own expense.

Tarrytown—Village makes a charge for street opening based on size and kind of pavement removed. Charges are as follows: Dirt streets, 5 cts. per square foot; macadam streets, 10 cts, per square foot; brick and bituminous macadam, 30 cts. per square foot; concrete and other types at cost.

Utica—Cost varies with depth of sewer and length of line, varying from $55.00 to $90.00.

Watertown—Actual cost plus road cut. Road cuts are as follows: Earth, 50 cts. per square yard; macadam, $2.50 to $3.00 per square yard; pavement, $5.00 per square yard.

Watervliet—$15.00 for dirt, gravel or macadam streets; $20.00 for granite block or other stone surface street without concrete base; $25.00 in concrete, granite block or concrete base or other kindred pavement.

Yonkers—$5.00 per each connected.

Water Mains Damaged by Lightning

Water mains in two streets at Danvers, Mass., were damaged by lightning last year, according to the 1926 report of Roger W. Esty, Superintendent of Water Works.

Preston St., from Nichols to Newbury, was so shattered that it was necessary to relay the entire section. By the use of a contractor's digging machine this street of 861 ft. was entirely relaid and hydrants and services connected in two days. Pine St. pipe, between Washington and Holten Sts., was struck by lightning and it was necessary to relay 97 ft.

Suggestions for Water Users

The following useful suggestions are given in the 1926 report of W. H. Lawrence, Superintendent, Water Department, Kalispel, Mont.:

To avoid any misunderstandings, secure copy of our rules and regulations.

Owners' or agents' signatures required for turning on water.

When buying property see that the water rent is paid, as all unpaid water bills are a lien against the property and will have to be paid, whether made before you buy the property or not.

Always bring or mail your last card when paying water bill.

Never put off paying your water rent when due (time flies); you may become delinquent and have to pay a penalty.

Payments will be accepted from tenants, but that will not relieve the owner, if tenants become delinquent.

Always notify the water department when changing residence; the charge for service goes on until water is ordered off.

Owners or agents should include the water tax with their rent, as owners of property served are held liable for all water bills and service charges.

The location of stop cock, or valve, in basement, or other place, for turning off water, should be familiar to every member of the family, and it should be seen to that it is always in good working order.

Leaks developing from frozen pipes or any trouble with house plumbing or service pipe, call your plumber, not the water department.

Very important for the protection of property that the curb cock should always be in good working order, and the curb box free from any obstruction (if broken, should be renewed at once).

In vacating or closing houses, especially in cold weather, see that all pipes, tanks, water-front, traps, etc., are properly drained; turning water off at curb does not drain house plumbing, simply stops pressure.

Leaks can only be detected by personal inspection; they are usually where they cannot be seen. Watch your water closet and stop and waste cocks.

Don't compare your bill with your neighbor's, simply for argument. The hydrant in yard, or barn, may be worn, or allowed to run. If your bill is excessive, do not blame the meter, for it is impossible for meters to register unless the water is passing through it.

When in doubt about your rates, etc., the office is the place to get information and not from others, who may advise you wrong. Do not allow others to get water from your service without permission from the office—you will be held responsible if you do.

No mistakes will be made at the office intentionally; should you find any, report same to the office promptly and they will be corrected. No one is infallible.